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COMMUNICATIONS
TO THE
BOARD OF AGRICULTURE;
ON SUBJECTS RELATIVE TO
THE HUSBANDRY,
AND
INTERNAL IMPROVEMENT
OF THE COUNTRY.
VOL. III.

ARATRO
DIGNUS HONOS

GEORG.

PART I.



LONDON:

PRINTED BY W. BULMER AND CO. CLEVELAND-ROW, ST. JAMES'S;
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CADELL AND DAVIES, STRAND; W. CREECH, EDINBURGH; AND J. ARCHER, DUBLIN.
1802.



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PREMIUMS
OFFERED BY
THE BOARD OF AGRICULTURE,
FOR 1801.

No. I.—*Condition of the Poor.*

To the person who shall draw up and produce to the Board, the best, simplest, and most practicable plan for ameliorating the condition of the labouring poor of this kingdom, by alterations in the poor laws, of easy execution, and without materially increasing poor-rates—the *Gold Medal*.

To be produced to the Board on or before the first Tuesday in March, 1802.

No. II.—*Cottages.*

To the person who shall build on his estate the most cottages for labouring families, and assign to each a proper portion of land, for the support of not less than a cow, a hog, and a sufficient garden—the *Gold Medal*.

Accounts of the expences of building—land assigned—culture, if any—live stock, and state of the families, with the rent paid—verified by certificates, to be produced to the Board on or before the third Tuesday in April, 1802.

The same premium for 1803.

No. III.—*Cows for Cottagers.*

Doubts having been expressed by some persons concerning the expediency of cottagers keeping cows, except on rich soils; the Board will give to the person who shall produce the most satisfactory account, verified by experiments, of the best means of supporting cows on poor land, in a method applicable to cottagers—the *Gold Medal*.

Accounts to be produced of the soil—articles cultivated—produce—stock kept—and every material circumstance—verified by certificates, on or before the first Tuesday in May, 1801.

The same Premium for 1802.

No. IV.—*Culture of Plants.*

To the persons who shall make the most satisfactory experiments tending to the improvement of the culture of each of the following plants respectively, viz. wheat, rye, barley, oats, pease, beans, tares, buck wheat, turnips, cabbages, rutabaga, potatoes, carrots, parsnips, clover, lucerne, sainfoine, chicory, hemp, flax, hops—*the Silver Medal.*

Accounts, verified by certificates, to be produced on or before the second Tuesday in May, 1802.

The same Premium for 1803.

The same Premium for 1804.

No. V.—*Cottage.*

To the person who shall build and describe to the Board the cheapest cottage, being at the same time durable and comfortable—*the Gold Medal.*

A plan, elevation, and account of the materials and expence, verified by certificates, to be produced on or before the first Tuesday in May, 1801.

The same Premium for 1802.

No. VI.—*Shoes for the Poor.*

To the person who shall invent and execute in a manner applicable to common use, the best and cheapest substitute for leather, in the shoes of the labouring poor, being an improvement on any, that may at present be in use—*the Gold Medal.*

A pair of shoes, with an account of the materials and expence, to be produced on or before the first Tuesday in December, 1801.

No. VII.—*Soiling Cattle.*

To the person who shall, through the entire summer of 1801, keep the greatest number of cattle in stalls, houses, or confined yards, and fed entirely in the soiling method with green food—*the Gold Medal.*

Certificates of the number of cattle, and acres of food, and sorts eaten, the quantity of dung made, with other circumstances of the experiment, to be produced on or before the first Tuesday in December, 1801.

The same Premium for 1802.

No. VIII.—*Waste Land.*

To the person who shall improve, and bring to the annual value of not less than 10s. an acre, the greatest number of acres heretofore waste, not less than fifty—*the Gold Medal.*

Accounts of the improvement, verified by certificates, including the state of the land before the experiment, and of the cultivation, expences, and produce, to be laid before the Board on or before the first Tuesday in March, 1803.

Notice of the intended improvement to be sent to the Board.

The same Premium for 1804.

No. IX.—*Draining.*

To the person who shall lay before the Board the most satisfactory account of one of Mr. Elkington's drainages—*the Silver Medal.*

The soil and state of the land before draining, the method and expence of the improvement, with

a plan and the result of the operation, to be produced on or before the second Tuesday in December, 1801.

No. X.—*Folding Sheep.*

To the person who shall, by a series of the most satisfactory experiments, ascertain the comparative advantages and disadvantages, and best method of folding sheep—the *Gold Medal*.

Accounts, verified by certificates, to be produced on or before the first Tuesday in April, 1803.
The same Premium for 1804.

No. XI.—*Irrigation.*

To the person who shall, in a country where irrigation is not generally in practice, water the greatest number of acres, and in the completest manner—the *Gold Medal*.

To the person who shall, under similar circumstances, water the next greatest number of acres, and in the completest manner—the *Silver Medal*.

Accounts of the old and new state of the land and value, the method, expence, and produce, verified by certificates, to be laid before the Board on or before the third Tuesday in January, 1802.
The same Premiums for 1803.

No. XII.—*Horses and Oxen.*

To the person who shall make and report to the Board the most satisfactory experiments on the comparison of horses and oxen, in the general business of a farm—the *Gold Medal*.

The account, verified by certificates, to be produced on or before the last Tuesday in April, 1803.
The same Premium for 1804.

No. XIII.—*Green Crops for Manure.*

To the person who shall give the most satisfactory account, verified by experiments, of the effect of ploughing in green crops for manure—the *Gold Medal*.

Accounts, with certificates, to be produced on or before the first Tuesday in March, 1802.
The same Premium for 1803.

No. XIV.—*Potatoes and Wheat.*

Potatoes and wheat, in constant succession, being the course of crops which affords the most abundant food for man, the Board will give to the person who shall make and report the most satisfactory experiments, on not less than five acres cultivated in that course during four years—the *Gold Medal*.

Accounts of the soil, culture, produce, application or price, verified by certificates, to be produced on or before the first Tuesday in May, 1804.

The same premium will be given (but not to the same person) for the same account of six years.

Accounts to be produced in May, 1806.

The same Premium continued.—Accounts to be produced in 1807.

No. XV.—*Manures.*

To the person who shall lay before the Board the most satisfactory account, verified by chemical experiments, or other sufficient authorities, of the nature of manures, and the principles of vegetation—the *Gold Medal*.

To be produced on or before the first Tuesday in December, 1801.

No. XVI.—*Manures.*

To the person who shall lay before the Board the most satisfactory account of the application and effect of manures, verified by practical experiments on not less than one acre for each sort of manure—*the Gold Medal.*

To be produced on or before the first Tuesday in December, 1802.

The same Premium for 1803.

No. XVII.—*The Weather.*

To the person who shall lay before the Board the most satisfactory paper on the means of ascertaining the probable state of the weather, so as to furnish useful information to the husbandman—*the Silver Medal.*

To be produced on or before the third Tuesday in May, 1801.

The same Premium for 1802.

No. XVIII.—*Instruments.*

To the person who shall give the best account, with drawings, of the various instruments of husbandry—*the Gold Medal.*

To be produced on or before the first Tuesday in April, 1801.

The same Premium for 1802.

No. XIX.—*Land for Cottagers.*

The Board having received information that the labouring poor on the estates of several persons in Rutland and Lincolnshire, having land for one or two cows, and a sufficiency of potatoes, have not applied, in the present scarcity, for any parochial relief; and it appearing to be a great national object to spread so beneficial a system, the Board will give to the person who shall explain, in the most satisfactory manner, the best means of rendering this practice as general through the kingdom as circumstances will admit—*the Gold Medal.*

To be sent to the Board on or before the first Tuesday in November, 1801.

No. XX.—*Cottage.*

To the person who shall produce to the Board the model of the best and cheapest cottage, on a scale of one inch to a foot; with estimates of the expence of erecting it—*the Silver Medal.*

To be produced to the Board on or before the first Tuesday in December, 1801.

No. XXI.—*Oven.*

To the person who shall produce to the Board the best Cottage oven, to bake, at one heating, bread sufficient for a family of six, for a week—*the Silver Medal.*

Cheapness of the oven and fuel essential points of merit.

To be produced to the Board on or before the first Tuesday in December, 1801.

No. XXII.—*Cottage Bed.*

To the person who shall produce to the Board the best and cheapest bed and bedding for a cottage, being an improvement on any already known—*the Silver Medal.*

To be produced to the Board on or before the first Tuesday in December, 1801.

No. XXIII.—*Experiments.*

To the person who shall produce to the Board an account of the most important experiment or experiments in Agriculture, made during the Year 1801 or 1802—*the Gold Medal.*

Accounts to be produced, verified by certificates, on or before the first Tuesday in March, 1803.

No. XXIV.—*Plough.*

To the person who shall produce to the Board the plough, which shall, with the least force, turn a furrow not less than six inches deep, and nine broad, in the best and neatest manner—*the Gold Medal.*

To be produced on or before the first Tuesday in February, 1802.

The plough which gains the premium to remain the property of the Board, the price of it being paid.

No. XXV.—*Carts.*

To the person who shall produce to the Board the cart or other carriage applicable to common use, in which one horse shall draw the greatest weight—*the Gold Medal.*

To be produced on or before the first Tuesday in February, 1802.

The cart which gains the premium to remain the property of the Board, the price being paid.

No. XXVI.—*Laying down to Grass.*

To the person who shall in the most satisfactory manner make the following experiment in laying down land to grass, on a scale of not less than three acres to each division, and report the result to the Board—*the Gold Medal.*

The land to be divided into three parts, one sown with grass seeds among barley or oats, in the spring, on land that was fallowed, or yielded turnips the preceding year: one sown with grass seeds alone in July or August, having been fallowed from the Michaelmas preceding: and the third sown with grass seeds and wheat early in September, having been fallowed or cropped with tares or turnips: the soil to be of the same quality; the grass seeds the same in each division. The grass to be fed with the sheep the first year. Accounts stating the comparative expences and success of the three methods, verified by certificates to be produced to the Board on or before the first Tuesday in December, 1803.

No. XXVII.—*Seed Wheat.*

To the person who shall, by the most satisfactory comparative experiments, ascertain the proper quantity of seed wheat to be used per acre, in the common or broad cast husbandry; not less than one acre to be applied to each quantity of seed—*the Gold Medal.*

Accounts containing a particular description of the soil and the preparation thereof, including the manuring, if any; also the time of sowing; the various quantities of seed employed; with the respective products, verified by certificates to be produced to the Board on or before the first Tuesday in December, 1802.

No. XXVIII.—*Seed Wheat.*

The same Premium as in the preceding Number, and on the same conditions, to be given for ascertaining the proper quantity of seed wheat dibbled on a clover or other lay.

No. XXIX.—*Seed Barley.*

To the person who shall, by the most satisfactory comparative experiments, ascertain the proper quantity of seed barley to be used per acre, in the common or broad cast husbandry ; not less than one acre to be applied to each quantity of seed—*The Gold Medal.*

Accounts containing a particular description of the soil, and the preparation thereof, including the manuring, if any ; also the time of sowing ; the various quantities of seed employed ; with the respective products, verified by certificates to be produced to the Board on or before the first Tuesday in December, 1801.

No. XXX.—*Seed Oats.*

The same Premium, and on the same conditions, to be given for ascertaining the proper quantity of seed oats.

No. XXXI.—*Seed Oats.*

The same Premium, and on the same conditions as in the preceding Number, to be given for ascertaining the proper quantity of seed oats dibbled on a lay, or on old pasture ground.

GENERAL CONDITIONS.

1. The Board reserves to itself the power of withholding any Premium when the communication or communications are not deemed sufficiently important to merit the reward.
2. The MS. &c. sent in claim of Premiums, to remain the property of the Board.
3. All memoirs, &c. sent in claim of Premiums, to be without names, but with a mark or number ; and accompanied by a sealed letter, (so which is to be written the same mark or number,) containing the name and address of the claimant ; which sealed letter will not be opened unless the Premium is adjudged to that mark or number.

COMMUNICATIONS
TO THE
BOARD OF AGRICULTURE.

COMMUNICATIONS, &c.

BOARD OF AGRICULTURE,

Tuesday, December 16, 1800.

EXTRACT FROM THE MINUTES.

Received a Requisition from the Lords' Select Committee, appointed to take into consideration so much of his Majesty's Speech as relates to the Dearth of Provisions.

RESOLVED, that this Requisition be referred to a Committee, to meet to-morrow at Two o'clock, and that special notices be sent to the Members this day.

GENERAL COMMITTEE,

December 17th, 1800.

Took into consideration the reference to this Committee of the Requisition from the Committee of the House of Lords, relative to granting permission to Tenants to break up Grass Lands.

RESOLVED, That the best mode of inducing Landlords to permit Grass Lands to be ploughed, will be by convincing them, that they may do it in many cases, not only without injury, but also to their advantage.

RESOLVED, That it be recommended to the Board, to publish the following Advertisement.

VOL. LII.

B

BOARD OF AGRICULTURE.

THIS Board having been required by a Committee of the House of Lords, "to examine into, and report to their Lordships, the best means of converting "certain portions of Grass Lands into Tillage, without exhausting the Soil, and "of returning the same to Grass, after a certain period, in an improved state, or "at least without injury," and being desirous that their information, on a subject of so great importance, should be complete, adapted to every sort of soil, and founded on the most ample experience, have come to the resolution of offering the following Premiums for that purpose, viz.

To the person who shall produce, on or before the first day of February, 1801, the best and most satisfactory Essay on the subject before mentioned, distinguishing respectively, what part of the plan recommended, or of the details given, is the result of actual experiment, accurate observation, or well-authenticated information—*Two Hundred Pounds.*

For the second best—*One Hundred Pounds.*

For the third best—*Sixty Pounds.*

For the fourth best—*Forty Pounds.*

And to such persons who may communicate information, which, though useful, may be considered of less importance, smaller Rewards, proportioned to the opinion of the Board.

It is required that each Essay shall fully detail the course of crops, regard being had to the varieties of soil, and the time proposed for continuing the land under tillage.

Also, to explain the cases in which it may be eligible to drain land, previous to tillage.

In what cases paring and burning are advantageous, with directions thereon, regard being had to the subsequent cropping.

The depth to which grass lands should, at first breaking up, be ploughed.

Whether the crops, intended for cattle and sheep, are to be fed on the land, and by which kind of stock, or carted off.

To state—

The crop with which the grass seeds, in each case, ought to be sown, when the land shall be again laid down :

The sorts and quantities of grass seeds for each kind of soil, and whether to be provided by landlord, or tenant :

Whether it be best to mow or feed the grass in the first year after laying down—to detail the management in each case :

The manuring which may be thought necessary :

The principle on which an increase of rent ought to be estimated, where permission may be given to break up old pasture now under lease.

The Board requires that these objects should be particularly attended to, with relation to the leading qualities of land, viz.

Clay, in all its distinctions; and soils too strong or wet for turnips :

Loam, in all its distinctions, fit for turnips :

Sand, including warrens and heaths, as well as rich sands :

Chalk-land, and downs :

Peat, including moory, sedgy, rough bottoms, and fens.

It is hoped that no person will be deterred from communicating his knowledge to the Board, on account of his experience being confined to one of these soils only.

The Board reserves the power of withholding any premium, in the case of no Essay being deemed sufficiently important to merit it.

The Essays which shall obtain any premium, or other reward, to remain the property of the Board.

Each Essay to be sent (sealed) without a name, but with a mark, or motto; and accompanied by a sealed letter with the same mark or motto, containing the name and address of the Author; and this letter will not be opened, unless one of the prizes, or some other reward, shall be adjudged to him.

All communications to be addressed (sealed) to Lord Carrington, President, Sackville-street, under cover to F. Freeling, Esq. General Post Office.

COMMUNICATIONS,
IN CONSEQUENCE OF
THE PRECEDING ADVERTISEMENT,
NOT IN CLAIM OF PREMIUMS.

Hints as to the Advantages of old Pastures, and on the Conversion of Grass Lands into Tillage. By Sir JOHN SINCLAIR, Bart. M. P.

HAVING corresponded with some intelligent proprietors, and practical farmers, on the important question recommended by the Board of Agriculture, to the attention of the public, namely, "*The Propriety of converting Pasture Land into Tillage*," I have thought it a duty incumbent upon me, as a member of the Board, and a well-wisher to the improvement of the country, to communicate the result of that correspondence, as several of the observations transmitted on the subject, seemed to be of considerable importance.

I. Advantages of old Pastures.

Before, however, the propriety of ploughing up old pastures is discussed, it may be proper, in the first place, to point out, some of the most important advantages to be derived from them.

1. The first advantage contended for is, that old pastures answer better for making butter and cheese than artificial grasses, and the idea is probably well founded. All seeds, particularly clovers, give the milk a strong taste, and although the quantity may be as great, or even greater, yet the quality is always worse, it will cast up less cream in proportion; the butter is less firm and waxy, and it will not keep so well. The cheese, also, is considerably inferior.

2. It is next asserted, that old pastures are better calculated for feeding cattle and sheep; but this can only be admitted with certain qualifications. In the opinion of that respectable farmer *Mr. Calley*, (who has had 50 years experience in the grazing line,) "*Artificial grasses, suited to the different soils, will be found to answer better than old grass, for feeding cattle, ewes, and lambs, during the beginning, and for the greater part of the summer; and even during the autumn, artificial grasses will feed ewes and lambs better than old grass; whereas on the other hand, jags (or after-maths as they are called in the southern parts*

"of England) from old grass, will certainly feed cattle better in the autumn, the richness, luxuriance, and strength of such herbage, being better calculated for their constitutions." It is believed, indeed, that it is hardly possible to fatten a large ox, to any degree of perfection, on herbage alone, without such pastures.

3. It is farther contended, that the hay made from old grass, though not so bulky, yet is of a better quality, and will keep longer in a good condition, than hay made from artificial grasses, particularly from clover and rye-grass.

II. *Description of the Lands that ought to be kept perpetually in Grass.*

As old pastures are attended with such peculiar advantages, it is desirable to know, what description of land, ought to be kept perpetually in grass. It is certain that there are many old grazing pastures, which can afford to pay a considerable permanent rent in grass, even at a distance from any populous town, the value of which might be reduced, if subjected to the plough. It is the opinion of Mr. Culley, that soft heavy loams, with a clayey or marly bottom or substratum, are universally injured by ploughing. Water meadows also, should never be ploughed, as they furnish so large and valuable a produce in spring, in summer, and in autumn, without any other help than water, whilst the manure made from that produce, goes to enrich the rest of the farm.

With these exceptions, and that of land apt to be overflowed, there is every reason to believe, that old pastures, may occasionally be converted, with public advantage, and private benefit, into arable land.

III. *Obstacles to the conversion of old Pastures into Tillage.*

Before, however, the conversion of old pastures into tillage is recommended, it is right to consider, what are the obstacles which may stand in the way of such conversion, for unless they are removed, any recommendation to that effect would be useless. These obstacles are, 1. Tithes, and, 2. The restrictions of the landlord.

In regard to tithes, whilst they continue undefined, they operate in a peculiar manner against the conversion of old grass lands into tillage, by depriving both the landlord and the tenant, of so large a proportion of the profit to be derived from it; and as there is every reason to believe, that a very considerable extent of land in England, is kept perpetually in grass, in order to avoid the payment of

tithes in kind, is it not a most unfortunate circumstance, that some means are not thought of, for commuting, on equitable terms, a right that operates injuriously to the agricultural interests of the country?

* As to the restrictions of the landlord, they are often necessary for the protection of his property. But in the course of the inquiry, it will probably be in the power of the Board, to point out the conditions, under which old pastures may be ploughed up, not only without detriment, but with advantage to the landlord, and to the public.

IV. *Preparation of the Soil.*

The preparation for the tillage crops may be considered under three heads:

1. *Draining*; 2. *Paring and burning*; 3. *Manuring*.

In regard to *draining*, it should be done effectually, before the land is attempted to be ploughed, for very possibly it may have been kept in pasture, on account of its wetness.

As to *paring and burning*, it is certainly a useful practice, where old grass lands are broken up, for it destroys numberless eggs and larvæ of insects, which are extremely injurious to the succeeding crops, and it almost insures the tenant, from any damage he is otherwise likely to sustain from wire-worms, grubs, &c. If the land is not pared and burned, the best plan to adopt is, to *double plough* it, by means of two ploughs following each other, the first plough taking off a thin surface of about three inches, and the second going deeper in the same place; both furrows not to exceed six inches. Mr. Duckett's skim coulter does the work at one operation. This plan is certainly the best to pursue, where *paring and burning*, from prejudice or any other circumstance, will not be permitted.

As to *manuring*, if the land is not to be pared and burnt, lime might be spread on the surface, some time before ploughing, in order to destroy grubs and insects; but old pasture lands, are in general rich enough to be abundantly productive, without dung, until they are about to be laid down into permanent pasture.

V. *Course of Crops.*

The rotation of crops, must depend upon the nature of the soil, and the manner in which it is prepared for cultivation.

If the land is pared and burnt early in the season, turnips is the best article that

can be sown; and it is found by experience, that turnips thus raised, will go farther in feeding cattle or sheep, than any other. If it is late in the season before the land is burnt, cole or cabbage may be adopted: if the land is broken up without being pared or burned, early oats will be found the most profitable crop, being so extremely productive on all fresh clean ground. Mr. Culley states, that there are various sorts of early oats, suited for the different soils: for instance, on rich leys of strong loam, *Polish oats* ought to be preferred, of which that sort called *Cibur's oats*, is by far the best variety. On lighter soils, the *Dutch*, or *Friesland* oat has been found to answer best: but on the whole, on loamy soils, no species has been found comparable to the *Potatoe oat*, so called from its having been accidentally found in a field of potatoes, in one of the Northern counties. In regard to the succeeding course, on dry soils, turnips, potatoes, and clover ought to be the prevailing green crops; on mixed soils, beans may be added; and when the mixture inclines to heaviness, cabbages. The following rotation is particularly recommended, on a lightish soil, by that intelligent farmer, Sir Alexander Ramsay; namely, 1. Oats; 2. Turnips, with dung and lime; 3. Barley with seeds; 4. Clover; 5. Wheat; 6. Turnips; 7. Barley and grass seeds; and then to remain in pasture.

VI. Management during the Rotation.

When land of a light quality is laid down with turnips, sheep should be folded on them. If the land is strong, or wet, the green crops grown thereon, ought to be drawn, and fed in some adjoining grass field, or in sheds. If the land is in very high health and condition, some farmers would be inclined to cart off half the turnips, and to eat the rest on the ground, though it is not a plan to be universally recommended.

In regard to manuring, it may be proper to observe, that the dung and lime ought to be applied to the turnips, or other green crop, but never to the different sorts of grain.

VII. Mode of laying down to Grass.

Grass seeds in general should be sown with the barley, or the crop succeeding turnips, or any other green crop that may be preferred: the quantity of grass seeds must be governed by the state and quality of the soil. Old tillage land requires, in addition to the clover, three pecks, or one bushel of rye-grass seed per acre;

whereas new ploughed lands, may do with half that quantity, or even less. Heavy lands require from 10 lbs. to 14 lbs. of red clover, if they are not to be broken up again in one or two years; but if they are to remain in grass, from 4 lbs. to 6 lbs. of marle grass or perennial red clover, and 4 lbs. of white. All dry soils, may have from 2 lbs. to 4 lbs. of hop or yellow clover seed per acre, in addition to the white clover seed, and the perennial red clover, or marle grass already mentioned. The following plan is recommended by Mr. Bridge, (a respectable farmer in Dorsetshire), for laying down land for permanent pasture; namely, to sow from 6 lbs. to 7 lbs. of white clover, ditto of marle grass, ditto of hop clover, and one bushel of the best Devonshire rye grass, which resembles much the Pacey rye grass. By this means, there is a perpetual feed for five or six years. The hop, clover, and rye grass, flourish early in the spring; the marle grass is in perfection in July, when the other goes off; and the white clover is in perfection in August, and continues during the remainder of the season. In some meadows of very rich soil, perhaps lucerne ought to be preferred, and it would be of infinite importance, to have it ascertained, to what extent that culture could be carried.

As to providing the seed, much must depend upon the character of the tenant; but as farmers in general are too fond of the plough, it is the safest plan for the landlord to provide the seeds, as it must be for his interest to procure the best that can be purchased, to prevent any necessity, from the unproductive state of the grass, to have again recourse to tillage.

VIII. *Increase of Rent.*

It is evident, that any tenant would be willing and able to give an increase of rent, for the liberty of ploughing up old pastures. What the addition ought to be, must be governed by the situation, the quality of the land, the price of grain, and other circumstances. In Scotland, double rent and upwards, is not unusual on a lease of four years. The Earl of Rosebery has lately let about 300 Scotch acres of old pasture, at that rate, some part of which produce £. 8. per annum.* It had been pastured, however, for more than sixteen years, and was situated within eight miles of Edinburgh. The high rent payable for such lands in Scotland, may be attributed to the following circumstances.

* Equal to £. 6. 8s. per English acre. In many instances, old pasture land, would fetch in Scotland, from £. 8. to even £. 10. per English acre.

1. That land fit for tillage, is less abundant in the northern part of the island than in England. 2. That old pastures are peculiarly well calculated for producing oats, the general food of the people;* 3. That such lands are in general so rich, as to require but little manure, consequently the manure arising from the crops they produce, may in a great measure be devoted to the improvement of the rest of the farm; and 4. That there is either a greater spirit of speculation among the Scotch farmers, or, that they are contented with less profit than the English.

IX. Conditions under which the Liberty of Ploughing may be granted.

But the increase of rent, is not the only particular that a landlord has to take under his consideration, when he grants the liberty of ploughing up old pastures. Unless care is taken, when they are broken up, that it is done under a proper system of management, the execution of which is enforced by the strictest regulations, the real value of the property may be materially injured. The conditions, therefore, that ought to be stipulated by the landlord, is certainly not the least important branch of this inquiry.

In considering the general nature of the conditions that ought to be required, I have derived much benefit from perusing the articles which were obligingly communicated to me, by the Earl of Rosebery, and according to which, that noble Lord, in January 1801, let a considerable tract of old pasture land, part of the estate of Dalmeny, in the neighbourhood of Edinburgh.

Art. 1. By this article, the fields were to be set up to auction, and the highest bidder was to find security to fulfill the terms he had agreed to.

Art. 2. The grounds were let for four years. 1st crop, *oats*; 2d crop, *turnips or other green crop*; if a naked fallow, four ploughings; 3d crop, *barley and grass seeds*, with two or three ploughings; and 4th crop, *hay*; prohibiting wheat, hemp, flax, &c. under the penalty of £ 10. per acre of additional rent.

Art. 3. The tenant to plough the land properly, to hoe and weed it, &c. to sow with the third crop, at least one bushel and a quarter, or one Scotch firlof of rye grass, 12 lbs. or 14 lbs. good red clover seed, and 4 lbs. white clover, and sufficiently to harrow, stone, and roll the same, entirely at his own expence.

Art. 4. The tenant to have liberty to cut and carry away the faggage, or second

* It appears from the corn tables, that wheat is almost always cheaper in Scotland, than in England, and oats the reverse.

crop of grass, in the fourth, or last year, but not to pasture the same,* and to remove every article belonging to him, on or before the 1st of November, 1804.

Art. 5. The tenant to preserve the gates and fences, to keep the ditches, &c. clear and open, and to leave them in good condition at his removal, and if neglected, the same to be done by the landlord, at the tenant's expense.

Art. 6. The tenant who shall be preferred, to sign a proper deed or instrument, with a sufficient surety, specifying the terms agreed upon.

Art. 7. Accommodation given to the tenant, to stack and thresh the crop, under certain obligations, that he shall keep the barn and corn yard in repair.

Art. 8. An arbiter appointed to determine all differences, the expence attending any dispute, to be paid by the person against whom judgment shall be given.

Art. 9. Tenants to remove, without the necessity of previous notice, under certain penalties.

Art. 10. Power reserved to the landlord, or to persons he may appoint, to inspect the fields from time to time, also to work coal and lime-stone, and other stones or gravel, to sink or dig pits, to make roads, and to do every thing necessary for carrying on such works, (allowing to the tenant, the yearly value of the ground thus taken up, or rendered useless), also, reserving the power of carrying off wood and underwood, paying the damages arising therefrom.

It is evident, that under such prudent conditions as these, if properly enforced, the most cautious landlord, may suffer old pasture lands to be converted into tillage, without any material risk of his property being thereby injured.

X. On the greater productiveness of Arable compared to Pasture Lands.

Having thus shortly stated, the manner in which old pasture lands may be converted into tillage, it may be proper briefly to explain, how much the public is interested in such a conversion, in consequence of the much greater quantity of food for man, that is produced by land in tillage. According to Archdeacon Heslop's comparative statement lately published, the weight of food from an acre of arable, on the average of three years, a fallow year being included, is nine and a half times greater, than from an acre of feeding stock; and according to the calculations of

* This restriction was intended for the preservation of young fences; but where the fields are completely fencible, Lord Rosebery prefers obliging the tenant to pasture the second crop of clover.

a very intelligent correspondent of the Board, the Reverend Dr. Walker, of Colinton, a Scotch acre of land in pasture, fed with sheep, produces only 120lbs. weight of meat; whereas the same land will yield 1280 lbs. weight of oatmeal, or above ten times as much.* This is so important a circumstance, in a public point of view, that it merits particular attention, as it tends to prove, that where one million of people may be maintained by pasturage, from nine to ten millions may be maintained by tillage, and without any additional extent of ground for working horses, cattle, &c. if the land is cultivated by the spade.

Conclusion.

On the whole, though it may not be advisable, to recommend the ploughing up of very rich old pastures, or water meadows, or land apt to be overflowed, yet with these exceptions, there is every reason to believe, that other sorts of grass lands, may be rendered much more productive, by being occasionally converted into tillage; and for that purpose it is desirable, that the conversion of such lands, should be promoted as much as possible;—by removing the obstacles to such conversion;—by enforcing the necessity of commuting tithes, without which, no considerable tract of old pasture can be broken up;—by pointing out to landlords, the conditions under which they may agree to such a plan, not only without detriment to the real value of their property, but also yielding a most important addition to their income;—and above all, by explaining to Parliament, and to the public, that the measure above recommended, is one which may effectually tend to prevent future scarcities; and to render this country, independent of foreign nations, in the important article of provision.

* If cultivated in whole, or in part, with potatoes, the difference would be still greater.

No. II.

*Essay on the Conversion of Grass Lands into Tillage, by John Walker, D. D.
Regius Professor of Natural History in the University of Edinburgh.*

MY LORD,

I WAS happy in observing, some days ago, the Advertisement from the Board of Agriculture, as it so much coincides with some ideas which I have long entertained on the subject. By means of the judicious and liberal premiums offered, the Board will, no doubt, receive copious and elaborate accounts respecting England: but I thought that some information also on the subject concerning Scotland, would not be disagreeable to your Lordship.

The numerous causes and remedies of the late and present scarcity form a field of very extensive consideration. I have confined myself, in the inclosed Memorial, to one cause and one remedy, both of them obvious and important. Whatever my ideas may be on the subject, at least they are not recently taken up, but are the result of the observation and experience of more than half of a century, in the rural affairs of this country. How far they are applicable to England, your Lordship, and others better informed than I am, can best judge.

I am assured, that if my sentiments on the subject were sufficiently known and diffused, they might be useful; but this I could not think of, till they had been submitted to the Board of Agriculture, whose approbation would give me very great satisfaction.

I have the honor to be, &c.

JOHN WALKER.

Edinburgh,
10th January, 1801.

Memorial concerning the present Scarcity of Grain in Scotland.

MANY causes have been assigned, and very opposite opinions have been formed concerning the present scarcity of grain in Britain. The causes which have been generally presumed are those of an occasional nature, or such as appear more immediately to have produced this calamity.

It is not these, but a cause of a more remote kind, which has been but little noticed, that forms the subject of this paper : a cause which highly deserves attention, as it suggests a remedy for the present scarcity, not only easy and effectual, but expeditious, as the salutary effects of it may be experienced in the course of the present year.

In hot and in warm countries mankind are disposed to live chiefly on vegetable aliment. The case, however, is different in the more temperate, and in the colder regions of the earth. In such a climate as that of Britain, mankind have a great propensity to prefer animal to vegetable food. This disposition is indeed much restrained, during the early periods of cultivation. But by high improvements of the soil, by the increase of wealth, and by the introduction of luxury, animal food is produced in greater abundance, and is become more accessible to all ranks of men.

Scotland is a particular and striking instance of this general observation. In former times the inhabitants consumed very little butcher's meat; and lived chiefly on grain, garden-stuff, milk, butter, cheese, eggs, poultry, game, and fish. The cattle which were raised went chiefly to England, and formed the principal article of export, before the Union. But since that period, though in consequence of increased cultivation, a much larger quantity of cattle is produced, the exportation has gradually diminished. By the improvements of the soil, by the increase of arts, of manufactures, and of trade, the consumption of flesh meat by the inhabitants is now, perhaps, ten times greater than it was at the end of the last century.

By this alteration, which has been most remarkable since the year 1750, the quantity of grain raised in Scotland has been greatly lessened. It is now insufficient, even in the best years, to supply the inhabitants; which is evident from the necessary and increased importation. By a greater consumption of meat, we therefore find a

remote, a gradual, but a most important cause of the scarcity of grain in the kingdom, for years past, and especially at present.

But by a larger consumption of meat at present, than in former times, not only the produce of grain, but human sustenance in general, is greatly diminished; and this of course must raise the prices of all sorts of provisions.

It may not be improper to mention one example of this among many which might be adduced;—a comparison between the produce of cattle, and of corn, upon the same land.

A Scots acre of good grass land, worth forty shillings of yearly rent, will support and fatten five of our best sheep from the 1st of May, until the 1st of November. During that time, the sheep will increase in weight 6 lbs. a quarter, or 24 lbs. each sheep. The meat therefore produced by this acre, during the season, amounts to 120 pounds. This meat at 6d. per pound yields £ 3. sterling. The tallow, skin, and offal may give £ 2. 15s. sterling, which form to the grazier a large profit of £ 2. 15s sterling from the acre.

Let us next consider the produce of the same land in grain. If the above acre be ploughed and sown with oats, it will afford on an average 10 bolls of that grain, which will yield 1280 pounds of oat-meal; little indeed used and esteemed in other countries, yet, from the experience of ages in Scotland, Ireland, and the north of England, it is questionable if a more wholesome and nutritive meal be obtained from any grain whatever.

It is true indeed, that the landlord as well as the tenant may receive from the above acre, when in pasture, as much profit, (perhaps something more) as by tillage, and with less trouble and risk.

But the difference which arises to the public, from these two different methods of occupying land, is indeed most surprising. A labourer, a manufacturer, or a mechanic, often consumes at the rate of a pound of meat each day. The 120 pounds of meat, therefore, afforded by the above acre, cannot support such a consumer above one-third of the year. He requires no less than three such acres to supply his wants for the single article of meat. On the other hand, the single acre affording 1280 pounds of oat-meal, is capable of supporting three laborious men in health and vigour, and with less additional sustenance than the former consumer requires.

The labourer, therefore, who lives chiefly on meat, demands for his support about nine times the quantity of land that is necessary for the sustenance of a labourer who

lives chiefly on grain. The population of Scotland, during the last half century, has been upon the increase. But this, and other subsidiary causes combined, are insufficient to account for that great scarcity of grain which has taken place of late years. The cause here specified, that is, the increase of pasturage, and the diminution of tillage, in consequence of the increasing demand for butcher's meat, has indeed operated gradually, but more powerfully, than any others in producing a scarcity of corn in Scotland.

As a remedy for this calamity, which threatens more and more to prevail, it is necessary to obviate and to remove this cause, by the extension of tillage, and especially on the present emergency.

The fertile arable lands in this country long occupied as pasture, are chiefly those in the possession of landed proprietors, or in large and extensive farms. If a due proportion of these lands were resigned to tillage, that is, from 50 to 100 acres in each parish, this would be an ample security against the scarcity of grain in Scotland, even in the worst of seasons. A landed gentleman, by breaking up 8 or 4 acres of his old grass, would do more to alleviate the present public distress, than he can possibly accomplish by the most rigid household economy, or by the most extensive use of substitutes for grain. The noblemen and landed gentlemen, on the present urgent occasion, have manifested the most laudable intentions towards their country. It is not easy to devise a measure better adapted for realizing those intentions, than that which is here proposed. Nor can it be doubted that, their example in this measure would be followed by the farmers and graziers.

It must also be noticed that this is a measure easy in its execution. Many noblemen and gentlemen retain in their own possession extensive grass grounds, with little or no tillage; the pasturage of such grounds *being to them* more profitable, and accompanied with less trouble and risk. In our climate, however, and upon our good soils, the pasture sensibly diminishes in a course of years, which is occasioned by a thick and luxuriant growth of the various mosses, or muscous plants on the surface of the ground. This renders it necessary, after a number of years, to break up such lands, and to subject them to tillage, for two or three years in order to restore and to improve the pasture: for this purpose, such grass grounds are usually let off for two or three years to neighbouring farmers. The crops commonly taken are two of oats and one of barley; and sometimes three of oats, after which the land is again let for pasture. Such fields having laid long under

grass, are remarkably fertile; and for the three crops of grain often give an annual rent varying from £5. to £8. per acre.

This proposal, therefore, of bringing old grass grounds into tillage, does not require a proprietor to engage in husbandry, or to provide ploughs, horses, and servants for additional tillage. All that he has to do is to let off, to produce two or three crops of corn, such parts of his grass ground as are most convenient, and which no doubt may be let at present, with mutual advantage, at a very high rent.

The grounds here meant to be broken up, are such as have laid under grass from eight to twenty years; and which may bear a rent of from twenty-five to fifty shillings for the Scots acre. The three white crops above-mentioned are highly profitable, and are well known not to be injurious to such land in such a situation.

The two crops of oats may be freely taken. The third year the land should be sown with barley, red clover and rye-grass, and with a considerable quantity of white clover. As the emolument from these grasses is to belong entirely to the landlord, the expence of their seeds and of sowing them, must be entirely his.

In the fourth year the landlord will receive from such lands a profitable hay crop of clover and rye-grass.

In this process no manure is necessary upon such lands. After the fourth year they are returned again to grass, with the pasture considerably improved; being freed from a matted mass of decayed roots, and an injurious growth of mosses, with which it was over-run.

It must also be observed as an additional and strong recommendation of this measure, that it is capable to afford the most immediate and expeditious relief from the present scarcity and high price of grain that we can well expect.

To obtain these ends, some measures though slow in their operations may be highly useful to remove the scarcity. By the reclaiming of waste land, and by improvements in the subsisting laws respecting corn, much future, though not immediate, relief may arise. Other means, such as importation, may diminish the scarcity, without reducing the prices.

But the measure here recommended tends to reduce the prices by the introduction of plenty, and that within the space of eight or nine months.

When corn is to be raised on grass grounds, an early season in winter is, no doubt, the most eligible for tillage: the months of January and February however answer

well, and on a pressing occasion, such as the present, they may be ploughed and sown with oats during the whole months of March and April. There is therefore time enough left for executing in the present season the measure here proposed. Such grass grounds as are above specified never fail to produce a plentiful crop of oats the first year in which they are ploughed; and if a sufficient quantity of such land be brought into culture before the 1st of May, there is good reason to be persuaded that, before the end of September, this part of the kingdom may be blessed with plenty and with cheapness.

No. III.

Essay on the Conversion of Grass Lands into Tillage. By John Dalton, Esq.

MY LORD,

I HAVE received the papers from the Board of Agriculture, which your Lordship did me the honour to send me, and I shall lose no time in putting them into the hands of those in this neighbourhood, whose opinions I think most likely to be worth the attention of the Board: in the mean time as the study of Agriculture has afforded me infinite pleasure, as well as some profit, for the last 35 years of my life, having generally from two to three hundred pounds a year in my own hands, I will give you my thoughts on the subject, on which the Board requires information, to the best of my judgment. They are the result of my own experiments, on such land as I have to deal with, all dry, on lime-stone or gravel.

The best method I ever found of converting grass land into tillage, is unquestionably by paring and burning—you get into a good course of husbandry at once, turnips, barley, &c. &c. and it is a mere chimera to suppose that the soil is diminished by it. I have myself pared and burned the same field twice in the course of fifteen years, and could never discover that the soil was in the smallest degree diminished by the operation. The earlier in the season the weather will admit its being done, the better; the month of May will do very well. When the ashes are spread, the field should be ploughed *true* but *shallow*, in order not to bury the ashes too deep, then harrowed very well, till fine, and ploughed shallow again across; this with a second good harrowing, will mix and incorporate the soil and ashes so well, that it is hardly possible to miss a crop of turnips, if any rain at all, falls during the month of June.

I have ever made it a rule, and recommend it most strongly, by all means to eat on the ground the *whole* of the crop with sheep and calves. Tenants will often

make pretexts to pull some off, but I never suffer it, though I fear it is sometimes done by stealth.

If old grass land, which answers well the valuable purposes of meadow, feeding, and the dairy, has a good colour, and is never mossy, I should not recommend the converting it to tillage at all, as I am fully persuaded, that after being delivered over to a tenant to be ploughed for eight or nine years, let the landlord or his agents take what care and precaution they will, they will not for many years see it equal to what it was formerly.

I am one of those Yorkshire gentlemen who have been so severely censured by the surveyors of our West Riding, for not letting long leases to our tenants, and permitting them to plough up what we call our old meadows and feeding land, to *improve our estates*. Much as we are disposed to respect the talents and abilities of those gentlemen who, after the cursory view which it was only possible for them to take in passing through so large a tract of land, were yet able to direct and instruct us, I have not heard of one country gentleman who has begun to improve in the manner they recommend.

There are unquestionably in most estates, some lands of an inferior quality, mossy, hide-bound, and ill laid down. These being previously drained, if they want it, may be taken up for tillage, under articles prescribed by the landlord, and signed by the tenant for the term of eight or nine years; and if the south country farmers resemble ours, it will require some sharp attention to see those articles fully and justly performed.

The crops I recommend are turnips eat on the ground—barley or oats—peas or beans—wheat: after which the land to be limed according to the proportions used—we only use a chaldron and a half here, and it works well in *fresh* land, which will produce turnips, barley, beans, and with them I recommend the sowing grass seeds. If I did not wish the land to be ploughed any longer than seven years, a wheat crop after the beans would, in my opinion, exhaust the land too much, to sow it down with grass, unless it underwent a further preparation.

I will now give your Lordship the result of my experiments in laying land to grass. I have practised three ways: The first and the most common is to sow the grass seeds with the barley, and I have known it answer very tolerably; but I am forcibly struck with the idea, that as barley after turnips is generally a large crop, and

takes its nourishment from near the surface it must naturally hurt the grass materially, which takes it from the same depth. To obviate this I sowed a field of four acres of good strongish loam with beans, but not full seed. With this I sowed twelve bushels of good hay seed, twelve pounds of white clover, four pounds of trefoil, and two pounds of rib grass. The beans not being too thick sown, did not rob, but sheltered and nourished the grass, and it answered beyond my expectation. I pastured it afterwards for four years, and this measure I strongly recommend. I manured it over once before I suffered it to be mown. It is now as good meadow as any I have, and has laid to grass fourteen years. My third trial was on a field of ten acres, which had been run out and abused by a very bad tenant. I gave it a complete winter and summer fallow, limed it and prepared it in every respect as if for wheat, and on the 1st of August, after harrowing it long ways as fine as possible, I sowed it with the same proportion of seeds as above mentioned, and brush'd it across with a bush harrow, rolling it over with a light wood roller. This field looked green before Martinmas, and by the middle of April was a good pasture; I did not however turn into it till Mayday, when it was very fine. I pastured it, as in the former instance, for four or five years, and it now lets to a tenant as high as any field in my estate. I prefer this method to either of the others, and though tenants will not relish sowing without corn, I recommend the practice to every gentleman who loves farming as well as I do.

It is difficult to form a judgment what addition of rent may be laid on, for the permission of taking up fresh land without knowing what crops, and what number of crops, the landlord will allow. The tenants greatest expence will be one pound five shillings an acre for paring, burning, and spreading the ashes; the subsequent three years will be only seed and labour, but from these data, added to a knowledge of the qualities of the land, it will be no difficult thing to judge of the farmer's profit, and what advantage the landlord should receive from it.

I recommend it strongly to gentlemen to procure the seeds themselves, of the best kinds, but the tenant should pay for them.

I have now, my Lord, exhausted all my very small stock of knowledge on the subject proposed. I never possessed an acre of clay land in my life, and therefore can say nothing on such land. Had I talents, my Lord, to write an Essay which might afford me a chance of obtaining the large premium offered by the Board, I should

assuredly refuse it, but I shall be highly gratified and amply rewarded if any hint I have given proves of the smallest use. I am happy too in the opportunity of assuring your Lordship, that I shall ever pay the utmost attention to any directions I receive from your very respectable Board, for whose unwearied pains for promoting the improvement of Agriculture, this country is so greatly indebted.

I have the honour to be, &c.

JOHN DALTON.

Sleningford, near Ripon,
January 6, 1801.

No. IV.

Letter on the Conversion of Grass Lands into Tillage, by George Maxwell, Esq.

MY LORD,

I HAVE received the honour of your Lordship's letter, with the advertisements from the Board of Agriculture, which I will take care to distribute as desired.

Though no candidate for the premiums held out, the personal respect which I bear for your Lordship induces me to offer such directions on the subject as result from my own practice, during nearly forty years, and on an extensive scale.

1st. Upon fen lands.

2d. Upon poor, stiff, strong clay soils, in some of which, great part of the land was over-run with large ant-hills and coarse sedge, and in others where there were but few ant-hills and little else but grass of a poor nature.

3d. Upon soils mild and good in quality though not yielding good herbage; and though not absolutely clay, yet too wet for turnips to be fed upon the land with advantage.

All the above sorts I have converted from grass land to tillage, and returned the same to grass after a certain period, in an improved state, and consequently without injury. Land of the first description, in all cases whatever, and of the second in each of its varieties, I would recommend to be pared and burnt at the beginning; but the mode of executing this upon fen land, is very different to that which should be practised upon the other.

1st. Fen land should be pared about an inch deep with a plough drawn by horses, and the ashes should be spread as soon as possible after they are burnt. The second ploughing should be from three to four, or even five, inches deep, according to the thickness of the upper stratum, touching as little of the moor as possible.— This ploughing ought not to be performed until the season arrive for sowing turnips or cole-seed, for either of which fen land is applicable, though the latter is generally

preferred, but both turnips and cole-seed ought to be hoed and fed upon the land with sheep; the plants of the former should be set out at least twelve inches asunder, and of the latter six. Fen land, if well drained, affords drier lair for sheep than almost any other land whatever. After the turnips or cole-seed, oats ought to be sown, the first crop of which, in most cases, will be too rank to admit of grass-seeds being sown with it, and therefore oats or wheat should be sown as a second crop, and, with that crop, white clover, commonly called Dutch clover, at the rate of 14 lbs. to an acre. A good herbage is by this means secured. Fen land has a great tendency towards grass, and neither the common red clover nor trefoil will live under water, and there are few seasons in which fen lands are not inundated for a time for want of constant winds to keep the engines at work.—The new pasture should be fed in the first and second year, and the stock should be mostly sheep, with a cow or other neat beast to every two acres; and if no horses are mixed with them, so much the better. No manure will be necessary till after the land shall have been mown for hay; and the longer that mowing is deferred, the better the herbage will be.

2d. Clay lands should be pared by hand with what is called a breast plough, to the same depth, or thereabouts, as the fen land; and the ashes should be immediately spread. This ought to be done as early in the spring as possible, and the land should afterwards be summer-tilled with two or three ploughings to the greatest depth that the soil will bear, and managed exactly in the same manner as old ploughed land. This sort of land not being fit for turnips to be fed off, though it will grow them to a great size, should be sown with cole-seed to be eaten on the ground with sheep. In the next spring, sow barley or oats, and twenty pounds of common clover to an acre, which may either be fed the year following, or mown twice for hay, but none of the clover should stand for seed. Upon the clover-ley sow beans in the following year, which should either be bood or sheep-fed. After the beans, sow wheat, and after wheat, a summer fallow again for cole-seed, to be fed off as before; and in the spring following, sow either oats or barley; and with that crop again convert the land to permanent pasture by sowing four bushels of meadow hay-seeds, eight pounds of trefoil, and eight pounds of Dutch clover, to an acre. Summer-feed the new pasture, as before directed, with respect to fen land; and defer the mowing for hay as long as convenient. No manure will be wanted while the land continues in pasture.

gd. The milder soils above described.

These should not be pared and burnt, but ploughed to the greatest depth that the stratum will bear, without bringing up any stiff clay; and if this be done with a plough so constructed as to take up one furrow under the other, the land will harrow, and the turf will rot, more expeditiously, than if ploughed only one furrow deep. Harrow in oats or barley, and, the next year, summer-fallow as before directed, (ploughing to the full depth of both furrows,) and sow cole-seed, to be fed off with sheep.—After the cole-seed sow oats, or barley again, or spring wheat may be sown with good effect; and with this crop sow common clover, to be used as before stated: after clover, beans; after beans, wheat; after wheat, again summer-fallow, for cole-seed, to be fed off as before. After cole-seed a spring crop of oats or barley, and the land to be laid down to permanent pasture with seeds of the same sorts, and in the same proportions, to be sown, used, and fed as before mentioned; the mowing for hay to be deferred as long as convenient. No manure will be wanted till that shall have taken place. The beans in both the above sorts of land will be very luxuriant; and I recommend that the tops of them be taken off with a scythe, as is usually done with garden beans, to prevent them from running too much to straw.

I would also recommend that the grass-seeds should be purchased by the landlord, and sown by some person in whom he can confide; for, in general, the tenant had rather the seeds did not grow; it being his wish, though certainly not his true interest if he is to continue the farm, to keep the land in tillage as long as he can.

In all the above-mentioned cases, the new pasture should be rolled with a heavy roller, and kept clear of stock of every sort during the autumn and winter, immediately succeeding to the sowing of the grass-seeds.

I have said that no manure will be necessary till the land has been mown for hay; but there can be no doubt that a great additional improvement will arise if manure of any sort be used; and the oftener the land is manured, the greater will be the improvement. All that is meant is, that improvement to a certain degree will necessarily result, if there be no manuring; and the advantage of having all the dung at liberty to be used on other parts of the same farm that may be in greater need of it, is so obvious that I forbear saying anything on that part of the subject.

In cases where the landlord finds the grass-seeds at his own expense, the great advantage to be derived from converting old pasture to tillage, and the improved

state of the grass when returned to pasture, constitute the principle on which an additional rent may be expected. I have hired old pasture land so long ago as twenty-five years, at an advanced rent of ten shillings *per acre, per annum*, for the privilege of ploughing and again converting it to pasture.

This, my Lord, is all that at present occurs to me on this particular part of Agriculture; but if what I now communicate should be thought of any value, I may hereafter trouble your Lordship with some hints on other matters that appear to me of consequence in the present trying juncture.

I have the honour to be, &c.

GEORGE MAXWELL.

Fletton, near Stilton,
Dec. 30th, 1800.

To the Right Hon. Lord Carrington, &c.

No. V.

*Letter on the Conversion of Grass Lands into Tillage. By Sir
Charles Middleton, Bart.*

MY LORD,

I HAVE received your Lordship's letter, accompanying the proposals of the Board of Agriculture, of prizes for the best Essays on the subject of breaking up and laying down meadows.

Though I am not desirous of any of the prizes, yet having tried the experiment, I take the liberty of submitting to your Lordship the result.

Having observed for several years, a meadow of fifteen acres, near the river, (which had been, before my time, arable land,) to produce very indifferent crops of hay, and having perceived, by an attention to the nature of the grass, that it must have been laid down out of heart, and without proper culture, I determined to break it up, and lay it down again properly; but as I could not afford dung to mend it, I took the following course:

I ploughed the land to the depth of eight or nine inches, and planted it with potatoes, of which I had a plentiful crop of more than 400 bushels *per* acre. The second year it was sown with turnips after several ploughings, but without dung, and was fed off with sheep fattened with oil-cake. The third year with turnips, again fed and managed in the same way. The fourth year with barley and hay-seeds; the barley was a good crop of seven quarters *per* acre, and the following crop of hay proved to be more than $1\frac{1}{2}$ load or ton of trussed hay *per* acre. It has ever since been cut for hay, and one year was cut twice.

My common practice has been to lay it up for hay, and to save the after-math for fattening sheep, or ewes and lambs, and to give it to them folded off in the same way as is done on turnips, with half an oil-cake or more to each sheep or ewe, in twenty-four hours. Since it has been laid down, I have never received less than one full load of dry hay *per* acre, but oftener one and a quarter or one and a half.

The soil is a light loam, mixed with sand, not naturally rich, and is more proper for arable than for meadow land. However, it lies near the river, and from that and other circumstances is kept in grass.

From this trial, I am satisfied, that meadow, as well as grass grounds, may be improved by being occasionally broken up, and may be able to produce more food for man and beast, than they can do by being always kept in grass.

The sorts and quantities of grass-seeds which I sowed, were as follows: on one acre ten bushels of London hay-seeds, two pounds of burnet, two pounds of trefoil, three pounds of rye-grass, two pounds of cow-grass, ten pounds of Dutch clover, and one pound of lamb's-tongue. Though I was obliged to proceed in this way, because I was not able to afford dung for laying it down again, yet I think the following may be a better method.

First year, oats or potatoes; second year, beans or pease, as the land may suit; third year, wheat; fourth year, turnips, very well mended; fifth year, barley or oats, with hay-seeds—not more than two bushels of barley sown *per* acre, on account of the grass-seeds; the sixth year it may either be cut for hay, or fed; but I prefer the first, and to feed the after-math in the way I have practised.*

By this method, corn may be produced in larger quantities, and the meadows, instead of being injured, may be improved. When suffered to lie three or four years in grass, the same practice may be renewed.

As the latter questions seem to relate more to the prizes, I do not trouble your Lordship with any opinion upon them.

I have the honour to be, &c.

Teston,
January 4th, 1801.

CHARLES MIDDLETON.

To the Right Hon. Lord Carrington, &c.

* Another course.—First year, potatoes; second, wheat; third, clover; fourth, wheat; fifth, turnips; sixth, barley; seventh, seeds.

ESSAYS
IN CLAIM OF
PREMIUMS.

No. VI.

*Essay on the Conversion of Grass Lands into Tillage, &c. By the Reverend
H. J. Close, of Hordle, near Lymington.*

MUTATIS REQUIESCUNT FÆTIBUS ARVA.

CHAPTER I.

*On the present State of Agriculture, the most obvious Obstacles to its Improvement,
and some Plans proposed for removing those Obstacles.*

AGRICULTURE, which by all politicians, is allowed to be the root, the seminal particle, from whence commerce in all its branches, should take its rise, is perhaps, the science, of all others, in which the inhabitants of the known world have made the least progress. Yet to secure food for man seems to be a primary pursuit, and, one would suppose, might instinctively attract the attention of the human species. Much certainly has been done, and many improvements introduced by a few individuals, within these last fifty years; but much more remains to be done, even by those who have made the greatest progress. Imperious necessity seems to call upon all Europe, and on this country in particular, to attend to this internal and certain source of national prosperity. Permit me, therefore, before I enter on the particular subjects which your Lordship, and the Board at which you preside, have selected with great judgment, for the immediate objects of your premiums, to state what appear to me, the most obvious obstacles to the improvement of agricultural knowledge; and to recommend to your consideration, such remedies for the existing evils, as may at least furnish hints for others, who have more leisure, and a greater fund of information than myself, to improve upon.

The obstacles I shall particularly call your attention to, are Tithes,—The difficulty and expense of inclosing waste lands,—Expensive and injudicious leases,—Want of knowledge in the practical farmers,—The great increase of the poor rates,—and a

want of that energy, which formerly characterized the agricultural labourers of this island.

Though a clergyman, and deriving the chief support for myself, a wife, and eight children, from the revenues of the Church, yet I must candidly acknowledge, that tithes operate as a direct tax on the skill, the capital, and industry of the country; and I believe most of my brethren would rejoice, could any other mode of payment be devised, which would secure to them, and their successors, the same rank in society which they now fill with so much credit to themselves, and with such advantage to the community. I am aware that this is a subject of the utmost importance, and that it will require the attention of the most skilful politician, to relieve the country from this oppressive tax, without injury to a most respectable and useful body of men. Indeed it is a subject which involves in it every thing which an Englishman,—a Christian, can hold dear. Our political and religious polity will be more firmly established, or shaken to the very foundations, as this question, whenever it may be agitated by the legislature, shall be well or ill conducted. Under these impressions, I should enter upon the subject with no small degree of agitation, were I not conscious, that, should the opinions of an obscure individual, like myself, prove erroneous, they will remain unnoticed by your Lordship and the Board of Agriculture; and if ever they should meet the public eye, they will be equally disregarded by the good sense, which, in this enlightened æra of society, pervades the nation.

The plan I am about to propose to the Board, is simply this:—Let the tithes of the kingdom be valued, and each proprietor of land have the refusal of the tithes of his own property at the valuation. Should this business be well conducted, the interest of half, or at most, three-fourths, of the capital thus raised, and vested in the public funds, would secure to the clergy, the amount of their present incomes; and the remainder of the capital might be an accumulating fund, to prevent the present incumbents, or their successors, from suffering any injury by an advance on the necessary articles of life, and a consequent depreciation in the value of the circulating medium. Once in four or five years, the average of the price of wheat, the staple and most necessary grain in the country, should be taken; and should it appear that an advance had taken place, the incomes of those who had disposed of their tithes, should receive a proportionate addition. But as no power on earth should invade the property of any individual, or oblige him to dispose of it without

his free consent, I would propose, that the attempt to release the nation from this tax, should originate with the King's most excellent Majesty, who is ever ready to alleviate the distresses, and add to the comforts of his people. His Majesty, with the consent of the Imperial Parliament, may undoubtedly dispose of all the preferment in the patronage of the Crown; and to induce the present incumbents to approve of such a measure, an addition to their incomes of fourteen or fifteen per cent. might be offered, to all those who have received a composition in lieu of tithes, and whose agreements commenced previous to the year 1795, or these years of scarcity. To others, the commissioners might make, in writing, such offers as seemed in their judgment equitable, from which no deviation should be made. Suppose the incomes of the parochial clergy, holding livings under the patronage of the Crown, to amount to £110,000. a year; to this calculation, if it may be so termed, must be added at least one-third, to come near the full value of the tithes arising from this preferment, independent of those belonging to the dignitaries, which are not included. This would amount to upwards of 146,000 pounds *per annum*, and at only twenty-six years purchase, though tithes are usually sold at thirty, would raise the sum of £3,796,000, which, at only four per cent. would secure to the clergy holding such preferment, their present incomes, and leave about £40,000. a year as an accumulating fund. The effect this would have upon the public funds, must be evident. His Majesty would not be deprived of his patronage; the clergy and their successors would be secure of holding their present rank in the scale of society; and the agricultural interest of our island would be exonerated from a burden, which is at present a constant subject of complaint. Were this scheme adopted, and put in practice with the livings in the gift of the Crown, and free liberty given to other patrons and incumbents to pursue the same plan, I am of opinion, no such mode of payment as tithes would subsist in twenty years. Let a proportion of every man's farm be free of tithes, and he may crop the other part so as to make it the interest of every Lay Impropiator to sell at a fair price; and with the clergy, there would be few who would make any objection, should the plan proposed appear to them, as it does to me, a very eligible one. I have been informed that Mr. Pitt has a scheme in agitation, somewhat similar to this. Should this prove true, he will have my hearty good wishes, and most sincere prayers for his success.

By another friend, I am assured the minister intends to substitute land in lieu of tithes. Though I should much suspect my own judgment, when it differed from a

man's of such transcendent abilities, yet I should not feel myself justified in suppressing my opinion, however erroneous, on this complicated subject. It may be comprised in a few words. Such a measure would be ruinous to the clergy, and injurious to the state. On real and naturally good soils, the evil would not be so great: but how can the clergy find skill and capital to improve lands naturally sterile and unproductive? Could they be justified in the attempt? and might not many families be involved in ruin, if capitals were sunk on so uncertain a tenure? To let such lands, to a person likely to improve them, would be impracticable. Some individuals, with more capital than judgment, might make the attempt, and certain ruin would be the consequence; but no man, with skill and capital, would enter on such lands without being secure of quiet possession for twenty-one years. I shall add no more on this important subject, trusting that it is in much better, and more able hands, and waiting with patience, the result.

The Difficulty and Expense of Inclosing waste Lands.

The many plans which have been formed, and the Bills which have been offered to the House of Commons on this important subject, have, in my opinion, failed by attempting to do too much, and thus raising an host of enemies to the measure, who either were, or thought themselves, aggrieved by some of the clauses contained in those Bills. Were I to venture to give an opinion on a subject which has been so fully and ably discussed, I should merely recommend the removal of obstructions, and a reduction of the present enormous expenses.

Might not a Bill be passed to render it unnecessary to have a separate Act of Parliament for every inclosure, and to empower the Magistrates at Quarter Sessions to judge of the expediency, or inexpediency of such inclosure; public notice being given in the paper or papers most usually circulated in the county in which the Common is situated, for three months previous to such measure being agitated at the Sessions. Should the Bench decide in favour of the inclosure, every method which can be devised for making it public should be adopted, and time sufficient allowed, for every person who could have the shadow of a right, to make his claim. The publicity of these measures should be such, as to preclude every pretext for new claimants appearing in an advanced stage of the business, from which, as the law now stands, much delay and expense have been incurred.

These previous measures being taken, might not five acting Magistrates, entirely disinterested in the inclosure, be nominated by the Bench to choose two commissioners to adjust the various claims? These latter to declare upon oath, that they are neither directly nor indirectly interested in the common; neither should they be relations, stewards, or tenants, to any of the claimants. Commissioners being usually appointed by the parties most interested, as at present, by the lord, the tithe-owner, and those who have a right of commonage, is a method which carries delay and litigation upon the face of it. Each commissioner feels interested for his employer, and endeavours to gain every advantage for him, which his skill and abilities enable him to obtain. No commissioner should be employed on more than one inclosure bill at the same time; from this not being attended to, much delay and confusion have arisen; and if, instead of paying these gentlemen by the day and mile, &c. a specific sum could be previously agreed upon, as a compensation for their trouble, according to the magnitude of the undertaking, it might expedite the business, and save a considerable expense. I am a great friend to task-work. If any claims should be brought forward, which in the opinion of the magistrates, (should they be thought competent to decide upon, and empowered to give judgment in such cases,) should appear frivolous and vexatious, the whole expense of costs should fall on such litigious claimant. The same penalty might be extended to the Court of King's Bench. Should the claims be substantiated, the expenses should be defrayed out of the general fund. But as the magistrates would, by such a law, be empowered to decide upon the law and the fact, and granting to these valuable members of society a full share of knowledge, yet cases must arise, in which they would not be competent to determine, might they not therefore be empowered, at the expense of the parties, to state any case or cases, and to take the opinion of the highest legal authority. This would, in most instances, satisfy the parties, and few would, after such a decision, attempt to remove the cause to the Court of King's Bench; especially if they were to pay full costs should their claims prove frivolous and vexatious.

The general saving clause, as the law now stands, should, in my opinion, be expunged. No rights should be preserved, which might render the whole business null and void. I can see no precaution necessary but the following, viz. If an allotment of the lands to be inclosed, be made to the ostensible owner of the estate, and he should afterwards be evicted of the estate by a person really entitled to such

an estate, the right of the allotment should be preserved to the owner of the estate. I should hope, with these precautions, claims might be tried at the Quarter Sessions, giving a power to the Magistrates to summon a jury, who should decide upon oath; and none of whom should be directly or indirectly interested in the common. In most cases this would be an easy and cheap method of adjusting the business, and no real injury could arise from vesting such power in the hands of Magistrates, if the verdict given at the Quarter Sessions were subject to the review of the Court of King's Bench, where the judgment upon the law might be final.*

Though the nation in general be fully convinced of the utility of cultivating the waste lands, yet, as some very sensible writers have argued against this measure, and adduced a very plausible reason in support of their arguments, it may be necessary to notice it.

These gentlemen assert, that it would require double the capital now employed, on the lands as present in cultivation, to bring them into their most productive state; and conclude from this, that a want of capital would render more inclosures injurious to the country. With these premises I fully agree, but much doubt the conclusion. That double or treble the present capital might be employed on the lands now in cultivation, so as to pay twenty per cent. I am fully persuaded; but I attribute this to want of skill, rather than want of capital.

When a man first takes a farm, he always engages in a larger business, than, even in his own opinion, his capital is equal to. In a few years he finds himself at ease, and has all the stock, &c. which he supposes necessary for his farm. After this, with the money he accumulates, he puts his sons, or relations into business, purchases a little land, or puts it out to use; and though it would require treble the capital to increase his stock, and to bring his farm into its most productive state, yet he never applies a shilling more to these purposes. There are thousands of instances of this sort, where skill, and not capital, is required. Another reason may be assigned, that it is not a deficiency in capital which retards agricultural improvements. When any estate is to be let, the difficulty is not to find a tenant, but to make a choice out of eight or ten candidates, all anxious to enter upon the farm, and all capable of finding capitals to stock it. This seems a demonstrative proof against the above conclusion, drawn by many sensible and well-informed men.

* For the greater part of these hints I am indebted to Mr. Francis Welles, at Upton upon Severn, a very able Solicitor, and a valuable member of society.

Besides, should the commons be inclosed, in numbers of situations, portions of land would be annexed to estates already in cultivation, so that the occupiers of such estates might cultivate the additional portions with but little additional capital; and where large allotments of waste lands formed new occupations, I doubt not but plenty of candidates would appear solicitous to occupy them.

Expensive and injudicious Leases.

The first obstacles which present themselves on this head, are the length and expense of these agreements: the next, the injudicious, I may say, injurious, covenants for cropping the lands. To curtail these agreements, and thus reduce the expense, I shall give a short sketch of what I consider a satisfactory lease. For information on the subject of cropping, I will refer the Board to the table, stating what appears to me a judicious method of cropping on various soils.

To simplify and curtail a lease as much as possible, I would recommend, after a short preamble, that every thing which the landlord covenants to do should immediately follow. Example—The *landlord* covenants to give quiet possession of the house, and out-houses, and to put and keep the same in repair; also to put the gates, stiles, and every sort of fence into repair; to ensure quiet possession of the above, and of——number of acres of lands situated in the parish of——for——number of years; to pay the land-tax; and to allow the tenant to hold certain parts of the buildings and lands for a specified term after the expiration of his lease. The *tenant* covenants to take the premises, to pay his rent in two equal half-yearly payments; to cart all materials for repairs, *gratis*; to find the workmen, when employed in such repairs, the usual allowance of wholesome beer; to keep and leave the gates, posts, rails, and every sort of fence in repair; to allow the landlord or his agents free ingress and regress, to shoot, fish, or hunt over the lands; to warn off every one, and to bring actions, if necessary, at the landlord's expense, against all persons who may trespass upon the premises: not to break up certain portions of meadow and pasture lands: to keep the ditches and water-courses open; to crop the lands according to the rotation recommended in the table at the end of this Essay, having respect to the different soils; to pay all parochial taxes; to expend the hay, straw, haulm, and other fodder, produced from the lands, upon the premises; and to use all the dung, soil, and compost arising from

the same, upon some of the lands belonging to the premises hereby demised ; except the produce of such dung and compost, &c. arising from the two last year's crops previous to the expiration of this lease, all of which shall be left, in a husbandlike manner, in the farm yards, or other convenient place, for the use of the landlord or incoming tenant : to leave all the straw of the last year's crop to the incoming tenant, he carting the corn to any market within the distance of ten miles : * to pay five pounds an acre additional rent for every acre of meadow or pasture land specified as not to be broken up, should he plough or till the same : to pay five pounds an acre additional rent for every acre cropped contrary to covenant : to preserve timbers ; not to cut, lop, or top, any pollard trees, underwoods, or hedgerows, under eight or ten years growth, according to the productiveness or sterility of the soil : to allow landlord or his agent to enter upon, to till and manure certain portions of land intended for summer-fallows, at a specified time ; and to sow grass-seeds with the barley and oat crops of the last year : to allow landlord or his agents to cut or fell timber, and to cart the same off the land at seasonable times. Here are the outlines of a lease comprised in a very short compass : should any addition be thought necessary, words need not be much multiplied. Why then should twelve or fourteen skins of parchment be used, and twelve or fourteen guineas expense incurred, for a lease and counterpart ?

On the Want of Knowledge in practical Farmers, as an Obstacle to agricultural Improvement ; with a Plan for carrying this Science to a Degree of Perfection, beyond what the most intelligent and spirited Farmers have at present attained ; and for diffusing generally through the Island the present Stock of agricultural Knowledge.

To improve upon the system of the most scientific agriculturists of the present day, I would recommend a large experimental farm to be taken under the direction of the Board of Agriculture, with accommodations for twenty or more young men ; who should each of them pay down, on entering, one hundred pounds caution money, as a security for their good behaviour. This money to be forfeited, should their

* This clause not to extend to dairy farms ; as, where a large stock is kept, the outgoing tenant should have permission to fodder his cattle with it until the spring, leaving the dung, &c.

misconduct be such, as may appear, in the opinion of a majority of the members of the Board, to justify such a measure, and the offender should be expelled with every mark of disgrace. These young agriculturists should also pay fifty pounds a year, more or less, for their board and instruction; they should be employed in actual labour on the farm for four or five hours every day, varying their employments, so as to make the business less irksome, and to teach them, by practical information, the value of every sort of work, and the quantity which ought to be done in a day. Four or five hours should be appropriated to other studies, particularly mathematics and chemistry, accounts and regular book-keeping. Each young man should keep a regular register of every transaction on the farm, with the expense and profit, written fair, and to be examined by the Gentlemen of the Board of Agriculture. For these purposes, a most able professor in these branches of science, should live in the house, who should have the superintendence of the pupils half the day; the other half they should be under the care of a practical and experimental farmer. This, though it appears to me, a most effectual method of improving the system of agriculture beyond what we at present can conceive, is nevertheless a work of time, and must be slow in its operation. I shall therefore mention an easy mode of diffusing, and rapidly, our present stock of agricultural knowledge, more generally through the kingdom. As I purpose being as concise as is consistent with perspicuity, I shall not enter into a long dissertation, on the slow progress which agricultural improvements make. It must be manifest, to every superficial observer, that the most convincing and self-evident improvement, may be practised in one parish for years, and never be heard of in another at ten miles distance. I should therefore strongly recommend to every nobleman or gentleman of large landed property, the following plan. Let those, who have estates in the counties, where the management and improvement of grass-lands, and of stock are well understood, take one tenant from the counties of Suffolk or Norfolk, where the farmers are almost a century before many other counties in the management of arable lands, and place him on a farm in a central part of his property, observing to transplant him from a soil somewhat similar to that which he is to enter upon. If strong loams, or clays, he should be sought for in what is called high Suffolk, or from similar soils in Norfolk. If gravels or light lands, he should come from what are deemed in those counties, the Sand lands. This would introduce a much less expensive mode of cultivating the lands, and a more judicious mode of cropping into many counties in England. But though I give

in the counties of Suffolk and Norfolk the most decided superiority in the management of lands, under tillage; yet I am of opinion, that the farmers in those counties are not less ignorant in the management of stock, and in the improvement of meadow and pasture lands, by irrigation or other judicious modes, than other counties are inferior to them in tilling and cropping the arable lands. Land owners in those counties would facilitate the improvement of their property, by adopting similar measures, and transplanting into each district a few tenants from situations where the management of stock, and the improvement of meadow and pasture lands, are better understood.

On the Increase of Poor's Rates, and a Want of that Energy which formerly characterized the agricultural Labourers of this Island.—The Causes and Remedies.

That the increase of the poor rates is an existing, a pressing, and a growing evil, no one will, I presume, be disposed to deny. The limits of this work will not permit me to enter on the history of the origin and progress of this evil. Yet I trust, I shall make it evident, that from one cause alone, the rates in many country parishes, have been doubled and trebled—the inadequate price of labour to the price of bread corn. For want of a due balance between the price of the staple of life, and the price of labour, almost the whole of the agricultural poor have been partly supported by parish allowances. Thus the farmers, who employ these men, and who are selling their corn at four times the average price when they hired their lands, throw the burden of maintaining the labourers, through whose industry they are accumulating wealth, immediately on the little independant gentleman, the shop-keeper, the blacksmith, and every poor mechanic. These industrious members of the community are also obliged to purchase every necessary article of life, from these very farmers, at quadruple the average price, and to pay enormous rates to support the labourers employed by them. I said that the burden fell immediately on these members of society, because a large proportion of it will ultimately fall upon the land owner, who, in years of scarcity, is not only purchasing the produce of his own soil, at an extravagant price, but is actually encumbering his estate with a permanent tax, to maintain the labourers of his tenants. This must be clear, as, whenever his present leases expire, whoever values his lands, must deduct, from the

intrinsic worth of those lands, the expense of the poor rates on an average for a certain number of years.

The next class of men I shall mention, as injured from, I must think our, at present, unfair mode of payment, is a very numerous one. It includes every industrious member of the community who depends upon daily manual labour for his subsistence. That the labourer is worthy of his hire can never be denied, and as, by his exertions, he gives to the public something which carries a certain intrinsic value with it, he ought in common justice and honesty, to receive some thing equally valuable, not subject to any sudden depreciation. If this conclusion be well founded, neither silver, nor any coin should be the criterion for forming a calculation upon, though useful as a circulating medium. Neither do I know of any standard but the price of bread corn. A shilling is only worth to a poor man, as much as it will purchase of his necessary food. When this is advanced to four times its usual price, the intrinsic value of the poor man's shilling is reduced to three-pence; and as he must eat, or he cannot work, he applies to the parish for an allowance of nine-pence for every shilling which he is calculated to earn in the week. If this do not tend to raise the poor rate to an alarming sum, I must be in a most egregious error.

But this evil, though great, is not the only one which has arisen from this injudicious, to say nothing more harsh, mode of paying the labouring poor. They are degraded in their own estimation; they have lost that honest pride which pervaded the aggregate body, at least all the valuable part of these members of the community, of having never been beholden to the parish for a shilling—a sentiment which has gratified my ears, and delighted my heart thousands of times.

Another evil has arisen from the same cause. These men have not only lost this stimulus to exertion, but such has been the pressure of the times, that the acting Magistrates have been under the necessity of giving another deadly blow to superior skill, strength, and energy, by their mode of applying relief. The plan, I have no doubt, was adopted as the most economical which could be devised, and economy in the distribution of parish money, was absolutely necessary. I do not mean therefore, to cast the least reflection on the acting Magistrates, where the plan, I am alluding to, has been put in practice. The gratitude of the country is due, in a great degree, to those gentlemen, who in these times of distress and difficulty, bear so large a proportion of the burden of the state, by discharging the duties of so

necessary and so troublesome an office. A more equitable mode of relief, perhaps, could not be devised, but the effects have proved very injurious to the general welfare and prosperity of our island. The plan I allude to is that, of ascertaining precisely, the earnings of each man, his wife and family, and enlarging or curtailing the parish allowance accordingly. This, at first view, may appear equitable, as every family must thus be enabled to live. But no one, by any exertion, can procure for himself and family any additional comfort. The effect of this levelling principle must be, that as all are paid alike, all will work alike; and as it is impossible, by any contrivance, to strain a man of a weakly frame, ignorant, and unskilful, up to a pitch, so as to equal one of double his strength, and ingenuity, the latter will naturally relax, and will never exert himself, either by task, or day work, to perform a greater proportion of labour than the former. These circumstances combined, have been attended with the most serious consequences. I am fully persuaded, that by the aggregate body of agricultural labourers, not more than three-fourths of the same work is performed, as was done ten years back, by the same number of hands.

I am aware, that it is much more easy to find out diseases in the natural, or political body, than to apply remedies: neither is it within the compass of my abilities, to devise any plan to effect a perfect cure for these existing evils. But much might, I think, be done. The first and most difficult task is, to raise the industrious and skilful labourers to their former station in society. In numbers of parishes, there are charities left for what are termed, second poor, viz. such labourers as have never applied for, or received parish relief. In the present state of things, few, very few such claimants can be found. Almost all those who have large families, must have received parish relief, and be precluded, by the unusual pressure of the times, from deriving any benefit from those charities, of which, they would be very worthy objects; and these are the very men whom the donors particularly intended to relieve. Might not an Act of Parliament be passed, entitling all the industrious poor, who had never received parish relief previous to these years of scarcity, to every emolument arising from such charities, as if such poor had never been chargeable to the parish. Should any poor of this description have been removed to their own parishes, they should have full power to settle in any other parish, as if they had never been burdensome, and in every case be considered as never having received parish relief. Having thus attempted to replace these valuable members of the community in their former independent stations, the next requisite

is, to guard against their being again degraded, by any sudden advance on the necessities of life. To effect this, the price of labour should be regulated by the price of bread corn. This seems but an act of justice, and I never could hear one valid objection to such a measure. This would not interfere with the freedom of either master, or workman. Here is neither maximum nor minimum fixed. The men may work, as at present, either by day or task. All, that such a regulation would effect, is to secure payment to the industrious and laborious, in something which should carry an intrinsic value with it. This plan properly adjusted, though it would secure food to the agricultural labourer, would not advance the price of wages to those manufacturers, who almost always earn more than enough to maintain themselves and families. Having introduced these regulations, I would have the law, obliging all the poor receiving parish relief to be badged, rigidly enforced, to mark more fully, the distinction between the one class of labourers and the other.

The subjects which I have discussed, as concisely as possible, though not immediately connected with those for which the premiums are offered, will nevertheless, I trust, be esteemed of the utmost consequence to the agricultural and general interests of the country, and may therefore tend to forward that improvement which your Lordship, and the Board at which you preside, so ardently wish.

CHAPTER II.

On the Management and Improvement by Tillage, of old Grass Lands on a direct Clay, such as is found in the Wilds of Surrey and Sussex.

THE substratum of this soil being impervious to water, the surface must consequently be continually saturated with moisture. Many landlords, on such soils restrict their tenants, by covenants, not to till or plough up the old grass lands, under an apprehension of the soil being exhausted by tillage and cropping. In this unproductive state, the land lets for from five shillings to seven shillings and sixpence per acre; and being always full of stagnant water, the produce consists of poisonous weeds, water quitch, and a little sour grass. Two acres will keep one

head of lean cattle alive for twenty spring and summer weeks. Some labour, and a considerable expense will be requisite to bring this stubborn sterile soil to a state of fertility.

I would first recommend the surface to be pared¹ and burned, and the ashes to be secured dry upon the headlands of the fields by a covering of earth, sods, or thatch. This operation must be finished in the summer. As soon as the autumnal rains have moistened the soil, so as to enable the plough to turn a furrow seven or eight inches deep, this operation should be performed, forming each ridge with only two furrows, three feet from the centre of one ridge to the centre of the other. Then let the scarifier, with three long tines or teeth, pass at the bottom of every furrow to loosen the soil five or six inches deeper. Water furrows should be cut, so as to lay the land dry and healthy all the winter. Should the winter prove favourable, the tops of these ridges may be harrowed down with the fixed harrow, and the scarifier passed again through the bottoms of the furrows, and the ridge formed over this deeply-pulverized soil: if not, they must remain until perfectly dry in the spring. In tilling soils of all denominations in which the clay predominates, this general rule should be observed, no injury will be sustained from ploughing them when wet, previous to the winter frosts; but all the horses on a farm had better remain idle than touch a furrow in the spring, until the soil be perfectly dry. When in this latter state, harrow down the tops of the ridges; scarify, with Mr. Cooke's scarifier, the bottoms, and once more reverse the lands, forming the ridges where the furrows were. Thus a depth of fifteen inches of finely pulverized soil will be obtained, by two half ploughings, two scarifyings, and two harrowings; at least the soil will be so much opened to that depth, as to admit the rain-water to pass freely. Every shower will not make a paste on the surface, neither will forty-eight hours sun form it into bricks. In short, by stirring this land deep, you avoid the injuries to which it was before exposed by excessive wet, or drought, and the soil will become healthy and productive. Should it not be sufficiently pulverized for turnips, scarify, harrow, and roll, with a heavy roller only five feet long, until a garden tilth be obtained, leaving the land, when completely fine, on three feet ridges. Previous to putting the ashes on for drilling turnips, beat down three or four inches of the tops of the ridges with a sled, or beam of wood five feet long, annexed to the handles of Mr. Cooke's scarifier. On this bed of finely pulverized mould in the furrows, spread the ashes; about eighty bushels on an acre. This work will be

easily performed, as the horse will walk in one furrow, and each wheel of the cart will occupy another. As the horses and the cart wheels will make the soil in the bottom of the furrows immediately under the ashes, compact, pass the scarificator through as before directed, with only three long tines or teeth in the centre of the beam, then with one bout of the common plough reverse the ridges and cover the ashes. Let the land continue in this state until the season suit for sowing. Then with the sled as before, level the tops of the ridges so as to obtain a surface on each ridge eighteen inches wide. Mr. Cooke's drill will sow two of these ridges at a time, two rows of turnips on each ridge, nine inches from row to row, with an interval of twenty-seven inches. The turnips, as soon as the rough leaf appears, should be harrowed across the ridges with the fixed harrow, then scarified between the rows, and a few days after these operations, they should be hand-hoed, leaving the plants in the rows single, and one foot apart. The intervals should be kept highly pulverized by alternate ploughings, horse-hoings, and scarifying; being careful before the autumnal rains commence, to throw all the mould from the bottoms of the furrows up to the ridges with a double mould board plough. This will not only keep the land dry and healthy all the winter, but as the horses will walk in one furrow, and each wheel of the cart will occupy another, the turnips may be carted to the bullock-sheds without poaching or injuring the land.

Knowing the difficulty, on these clayey soils, of obtaining a fine tilth for spring sowing, I should recommend the same ridges, after the turnips are drawn and carted home, to be worked with the fixed harrow and roller, only so as to obtain a fine tilth five inches deep, and then to drill two rows of oats, nine inches from row to row, leaving a furrow or interval of twenty-seven inches. When the oats are about two inches above the surface, harrow across with the fixed harrow, scarify twice in a place between the rows of oats, and roll the whole. After these operations, should weeds appear, horse-hoe with the flat hoes. When the oats are harvested, throw your ridges up high, like trenching in a garden, without reversing them, keeping the bottoms of the furrows clean from mould, and laying the land perfectly dry. In the first frost, cart about twenty loads per acre of good horse or bullock dung, not too rotten, into the furrows; spread it, and as soon as the frost is out of the land, harrow or sled down the tops of the ridges, reverse them, and cover the dung; the first dry weather in February or March, sled down the tops of these ridges, to obtain a surface of eighteen inches, and drill two rows of beans on each

ridge, nine inches from row to row, and twenty-seven inches interval. Scarify, horse-hoe, and plough, between the intervals, so as to keep a fine tilth, and to destroy the weeds. When the beans are fit for harvesting, pull them, and when carried off the land, pulverize the tops of the same ridges by scarifying, rolling, and working with the fixed harrow; and if any surface weeds appear, skim the land with the scufflers, and by repeating these operations, prepare the same ridges for wheat, and drill two rows on each ridge nine inches from row to row. In the spring, harrow across, &c. as directed for the oat crop. Should the farmer wish to substitute cabbages for turnips, one row should be planted on each ridge, setting the plants two feet and an half from each other in the rows, with three feet intervals. In this succession of crops, viz. turnips or cabbages, oats or barley, beans, pease, and clover, and wheat, even this naturally sterile soil will be in a constant state of improvement: and if the vegetable crops and straw be expended in the most advantageous method on the farm, the land may be dressed with fourteen loads per acre twice in the four years; viz. for the turnip or cabbage crop, and for the bean, pea, or clover crop. I shall not therefore limit the number of years for keeping it in tillage to any precise term, as it appears to me immaterial; * but proceed to point out the best method of securing a good meadow, whenever the occupier may wish it.

We will suppose the land cropped eight years in the rotation of crops before recommended, and at the expiration of that term, a wheat stubble. The first operation I should recommend, would be to drain the land so as to take off the surface water, for nothing more can be effected by draining these lands, as they will hold water like a bucket, and were the drains cut ever so deep, and only six inches from each other, the water would not draw from one to the other. The method I shall propose is easy and efficacious, and the expense very trifling. I speak with confidence, as almost the whole parish of Hitcham in Suffolk, where twenty years back it was thought impossible to grow barley, now produces fine and heavy crops of that grain, by the surface water being taken off expeditiously. Open furrows in the wheat stubble with the common plough, about five yards from each other, and

* Old grass lands converted into tillage, (though they might be ploughed by a judicious system of cropping for any number of years,) if naturally crude and unproductive, should not, I think, be sown with grass seeds in less than eight years.

as deep as the land was ever ploughed and scarified. Then with a narrow gripping spade, twenty inches long, and only two inches and an half wide at the top, and one at the bottom, open a drain sixteen inches deep, fill this with the wheat haulm, ramming it down as hard as possible: the price two shillings and sixpence per score rods, to dig and fill up. It is, I presume, unnecessary to observe that these and all other drains should not be cut in a line with the natural fall of the land, but in an oblique direction. No bushes should be used, as when these begin to decay, pieces of them will fall across these very narrow drains, and obstruct the course of the water. The straw or haulm, when it decays, sloughs off, and the water passing through the clay forms an arch, which will last many years. There are drains of this sort still open in Hitcham parish, which have been cut more than twenty years. Having thus freed the land from the noxious moisture arising from stagnant water, with one bout of the plough, throw the land on to three feet ridges, and before January reverse these. In the spring, when perfectly dry, harrow down the ridges with the fixed harrow; roll, plough, and harrow, so as to make a complete fallow;* then dress with lime or compost; and balk the land, viz. give it half a ploughing, leaving it in narrow ridges, so as it will harrow down quite level and fine without any furrows appearing. In the beginning of August, sow thirty-two bushels per acre of the sweepings of hay chambers, where only good old meadow hay has been used without any broad clover and rye-grass, five pounds of Dutch clover, and five pounds of trefoil; harrow the seeds three or four times over, and you may expect two tons, or two tons and an half of hay per acre, the first year, which will pay all the expenses, and leave the land improved from five shillings, or seven and sixpence per acre, its original value, to fourteen shillings, or sixteen shillings per acre.

And now, Gentlemen, as you seem particularly desirous of obtaining information from actual experiment, permit me to assure you, that though I have not given you, neither is it in my power, an exact detailed account of an experiment I made on fifty acres of land in the wilds of Surrey, yet the great outlines of the plan, and the general result, correspond with my actual practice. I purchased nearly six hundred acres of land in that country for three thousand six hundred pounds, the stock and

* The scarifiers would be dangerous instruments to use after the drains are cut, as they, by penetrating too deep, might pull down the sides of the drains, and bring the haulm to the surface.

crops were valued to me at about five hundred pounds, and the rent of the major part of the land estimated at five shillings per acre. After farming it some years, I let the whole at ten shillings per acre; the tenant paid me for the stock and crops two thousand and eighty pounds, and I afterwards sold the estate to him at nearly double the price I gave for it; having previously paid myself the greater part of the expenses for the improvements I had made. Fifty acres of the land will more particularly elucidate this subject. Part of it was broken up from old sour grass, not worth five shillings per acre, and part of it was old tillage land, which had been limed and cropped until it literally would produce no weeds except the sow thistle. After treating these lands as nearly as I can recollect, according to the system I have recommended, I fallowed and dressed them with a compost of lime and earth, and sowed the quantity of seeds I have mentioned, at or near the season recommended, and the produce was estimated at two tons and an half of hay per acre; and the fifty acres of land which were valued at five shillings per acre when I purchased them, were estimated at fifteen shillings per acre when I sold the estate. I did not surface drain the land, as I was not then acquainted with the system, neither did I pare and burn, but dressed with a compost of lime and mould. The system I have recommended differs from my actual experiment in these two circumstances. But the surface draining has proved effectual in the parish of Hitcham, and seems to carry conviction with it; and by paring and burning, as good a dressing as the lime may be procured, at a much less expense. Many may object to paring and burning, and ploughing these lands into what is termed, by the farmers, the dead earth. I am of opinion these operations are pernicious, on really thin skinned soils, when the immediate substratum is much inferior to the surface. But in the soil I have been treating of, the only difference between the surface and the substratum, consists in the former having been exposed and pulverised, and the latter having remained impregnated with stagnant water, and never turned up, so as to derive any benefit from the vicissitudes of the atmosphere. By paring and burning you destroy the surface weeds, and obtain a cheap dressing; by ploughing the land deeper than ever it was ploughed before, exposing it to a winter's frost, and summer's sun, and dressing it with ashes or lime, you obtain a depth of sweet mellow soil not easily injured by wet or drought, and adapted to all the purposes of vegetation. To prove the utility of moving these clay soils fourteen or fifteen inches deep, let any one cover a pewter dish, or any substance, like the substratum of these

lands, impervious to water, with earth one inch deep, and expose it to a trifling shower, and the whole mass will become a quagmire; let another dish be covered with the same soil fifteen inches thick, and it is evident it will require fifteen times the number of cubic inches of water to put this into the same boggy state. The former also, by twenty-four hours dry weather, will become as hard as a brick, when the other will only have a slight incrustation formed on the surface. Supposing this effect to be produced on your field, by passing the fixed harrow once across the land, it will be put into a state of fine pulverization. By drilling on three-foot ridges, you keep the land in a dry healthy state, and by sowing your spring crop on the same ridges, you obviate the only objections to growing green winter crops on wet lands, viz. cutting up the lands by carting off the crop, and the impracticability of afterwards preparing them for spring sowing. In carting, the horses walk in one furrow, and the wheels track in two other furrows; the tops of the ridges are always dry, and the fixed harrow passing twice in a place will prepare such lands for sowing, before the farmers, in the common mode of management, without a crop of green food, can put a hoof on their lands. Should surface weeds appear before sowing, Mr. Cooke's scufflers, or broad shares fixed in the scarifying beam, should be passed through the land.

CHAPTER III.

On the Management and Improvement, by Tillage, of strong wet Loams, in which the Clay greatly predominates.

HERE again I can meet the wishes of the Board, and give them the information they require from actual experiment, and on a very large scale. This soil, of which there are thousands of acres in Suffolk, is in that district called clay; but I believe there is no pure clay in that county. The lands having a greater or smaller portion of calcareous matter in them, are consequently of a better quality than the clays in Surrey and Sussex, though they were in no higher repute until within these twenty years. A panor farm near Eye, was offered for sale about fifteen years

since, when I purchased it, much against the inclination of my friends, who joined in the general cry of the farmers, and pronounced the lands the poorest that ever grew over. This did not discourage me. I found a proportion of calcareous earth intermixed with the clay on the surface, and at two and three feet below the surface, a stratum of fine marl in almost every field. The estate was so depreciated, that I did not attempt to let it. Of the two hundred and thirty-five acres, of which the whole consisted, the major part was old sour grass lands, full of water quitch, over-run with black and white thorn, bushes, and pollard trees. I began my operations by grubbing the thorns and trees, levelling all the old fences, and filling up the ditches where they formed inconvenient angles and corners. Then the fields were squared; new ditches cut, four feet and an half wide at the top, one at the bottom, and three feet six inches deep, and planted with white thorn: expense per rod two shillings and three-pence, exclusive of white thorn and hushes. Drains were then drawn out as deep as possible by the plough, dug with the common spade ten inches, then with a narrow spade ten inches,* and with a small gripping spade fourteen inches, filling the latter trench with haulm, and putting bushes on the top of it, covering the whole with mould. Heath, where it can be procured, is preferable. Expense per score yards, four shillings and sixpence. Marl-pits were then opened, when possible, at the point where four of these new ditches met, by which the distance of carting was reduced, and with a few posts and rails the fences were made good, and a permanent pond of water secured to each field, after the marl-carting was finished. Eighty loads was the quantity per acre, at two pounds twelve shillings and sixpence per hundred loads.

This marl was spread on the old sour grass, and left to be pulverized by the winter's frost, and incorporated with the surface by the feet of the cattle and sheep. Early in the spring, the lands thus prepared, received one clean deep ploughing, and were drilled with oats; produce about thirteen quarters per acre. The second year drilled with peas; produce seven quarters and an half per acre: ever since which time they have been cropped regularly, and the produce has been immense. That the Board may form an accurate idea of the advantage derived from converting these old grass lands into tillage, I shall state the value of the farm *per annum* when I purchased it, and the money I gave for it; then the sum I received

* In the old grass lands the sod was reversed and placed over to the bottom drain, which formed an effectual covering.

for my improvements ;—the rent at which I let it on a twenty-one year's lease ;—and the price I received for it when sold. There were two hundred and thirty-five acres, valued at one hundred and twenty pounds *per annum*, (the tenant paying twenty pounds a year land-tax,) and the price I paid for it three thousand three hundred pounds. I received for my improvements of the tenant five hundred pounds ; besides three hundred and fifty pounds which the old pollard trees sold for ; let the farm for two hundred and twenty pounds, the tenant paying twenty pounds a year land-tax, and covenanting to keep all the buildings, &c. in perfect repair. I then sold it for six thousand five hundred pounds. The gross produce per acre of these old sour grass lands could not exceed twenty shillings ; and little or nothing was expended on productive labour. Ever since they have been converted into tillage, double the former gross income must have been expended for labour, and the aggregate produce at least six pounds and six shillings on every acre, including the whole rotation of crops. You have here, Gentlemen, one strong proof of the utility of converting certain portions of grass lands into tillage. This farm is now in such a high state of cultivation, that any part of it might be converted into meadow land by the mode recommended in my former chapter, and would be worth two pounds per acre, as I shall demonstrate from actual experiments on rather inferior, though somewhat similar, soils.

When I first became Rector of — in the county of —, there were two fields of fifteen acres, much impoverished by constant cropping and tillage, valued, in that state, at sixteen shillings per acre ;—soil a strong loam, and very wet. These fields I drained, to take off the surface water, as recommended in my first chapter : then fallowed and dressed them, sowing the hay-seeds, &c. in August. The produce the first year was estimated by many farmers at four tons per acre ; it was so stout, that the mowers had double the usual wages, and it was impossible to spread it on the land. I have ever since, viz. for eight or nine years, let these lands at two pounds two shillings per acre. As the tenants have been frequently changed, the lands have been mown almost every year, and are now somewhat exhausted, but may be made as good as ever by a dressing, and by being fed with sheep one summer ; or, if ploughed, would produce abundant crops for eight or ten years, and might then be converted into meadow by the process I have before recommended. Whilst such soils, as I am now treating of, are kept in tillage, I would recommend the course of crops, which will be found at the end of this Essay, as best adapted to clayey loams. By

the mode of cropping there recommended, a farmer may continue sowing wheat in any season. If too wet to work his pea, bean, or vetch land, his clover lands will be in order; if too dry for the latter, the former will work well, and he may be sure of putting in his seed in good time. It will be obvious, that when clover is sown with the spring corn, the three-feet ridges, on which the turnips or cabbages grew, must be levelled, and five or ten-feet ridges formed. The clover-seed should be sown immediately before the last horse-hoeing. I could bring proofs *ad infinitum*, to demonstrate the folly of allowing old grass lands to remain untilled, under the foolish idea of not impoverishing the land. So far from being improved by such a state of rest, the lands, by being saturated with stagnant water, become worse and worse every year; and one hundred acres in this state, at seven shillings and sixpence per acre, would starve the tenant and his cattle, bring a very poor rent to the landlord, and produce nothing to the public. Under the management I have recommended, the income of the landlord may be nearly tripled, and the produce to the tenant and the public increased in a tenfold degree. But I will, as the Board requires, substantiate these assertions by further experiments made under my direction, on some lands in Sussex, belonging to his Grace the Duke of Richmond, and on others in Suffolk, the property of Lord Rous. One will be an additional proof of the utility of breaking up old sour grass lands; the other, of the advantage, of restoring lands exhausted by constant tillage, into good and productive meadows. It may be necessary to say, that I applied to my two noble friends for an account of the following experiments, and received permission to transmit them to the Board.

The farm of Lord Rous consisted of two hundred acres of land, half of which was old sour grass, let for ninety pounds a year, but previous to my riding over it with his Lordship, his steward had valued it at one hundred and fifty pounds a year, allowing a specific number of acres to be broken up every year, on condition that the tenant laid down with hay seeds an equal number of acres of the old arable lands. I stated to Lord Rous, that he could not have a full and fair rent for his farm under these covenants, or without allowing the whole to be cleared, ditched, drained, marled, and ploughed, except about ten acres near the house. To these conditions he readily, and from conviction, acceded; and I valued the estate, (which was then let at ninety pounds a year, and estimated with a partial privilege of breaking up the old pastures at one hundred and fifty pounds,) at two hundred and

twenty-five pounds; for which sum it was let to an unexceptionable tenant, so much approved of, that at the end of three years, before he had reaped the fruits of his own industry, his Lordship offered him much larger occupation, if he could find a tenant of character to repay him for his expensive improvements. Several candidates offered, out of whom Lord Rous selected one who paid the outgoing tenant five hundred and fifty pounds for his ditching, draining, and marling, and expended about two hundred pounds more in similar improvements. Precisely the same system was adopted by these spirited farmers for improving these lands, as I have before given the particulars of in the account of the estate I purchased; and a recapitulation would be protracting this Essay, which I wish should contain, in the most concise and plain terms, as great a mass of information as I am capable of furnishing.

As his Grace the Duke of Richmond, with that exactness which marks his conduct in all matters of business, has furnished me with an account of his experiment attested by his signature, I should not feel myself justified in deviating from it, even in form, but shall transmit it, in the very words in which I received it. "I do certify, that some years ago above fifty acres of land that I wished to convert from tillage into pasture, which had been attempted several times by the common mode of sowing grass-seeds with eorn, without success, were (after two years successive turnips fed off) sown with hay-seeds in a very large proportion, in August, without eorn, as advised by the Rev. Mr. —, and the result was, two crops of hay the first year, one estimated at two tons per acre, and the other at one ton and an half. The land has since been dressed with old mortar and other manures occasionally, and the permanent improvement on the value of the land is estimated to amount to at least fifteen shillings per acre." *

January 23d, 1801.

(Signed)

RICHMOND.

These experiments so exactly correspond in their result with those which I have stated from my own practice, and being made in different situations, they seem to be conclusive on the most important subjects, selected by the Board as objects of their premiums. The characters of the noblemen, under the sanction of whose approbation I have given you the particulars of the two last experiments, stand too

* By a letter previously received from the Duke of Richmond, his Grace informed me this was exactly double the value of the land.

high in the estimation of the country for honour, veracity, and minute exactness in every transaction of the least importance, to need any encomium from me. For the particular management of these experiments, I shall refer you to those similar ones made upon my own lands, from which no variation was made except in the mode of draining the Duke of Richmond's lands, which, to the best of my recollection, were drained with bricks.

Though the query respecting the utility of draining may be supposed in effect to be answered by its being the foundation of all the advantages which I have so minutely detailed, yet I must urge the necessity of this operation, as the *sine qua non*, of agricultural improvement; and add, that though the particular method of surface draining strong clays, and of clayey loams, where the substratum was less retentive of water, has proved both cheap and effectual, yet in all bogs, peats, gravels, or sands, where a large tract of land may be made firm and dry by one cut, Mr. Elkington's mode of tapping and boring, is a very superiour method of effecting this necessary and primary improvement. Upon rich black loams, sandy loams, good deep lands, with a chalky substratum, peats, &c. (all soils capable of producing the natural grasses of this country,) the same system as has been recommended in the preceding experiments, will be found effectual for converting them into meadows or pastures; only varying the rotation of crops according to the table at the end.

Objections to sowing artificial Grasses with any Crop of Corn, when it is required to obtain a Meadow; and a comparative Estimate of the two Methods.

Here again I can give you, my Lord, and the Board, information from actual experiment. A friend of mine wished to procure a good meadow or pasture around his house: he fallowed the land for barley; but the spring proving wet, and the soil being a strong loam, he could only put half of it in order for that crop, which was sown, and laid with clover and rye-grass. The other part was fallowed and sown in August, with the sweepings of hay chambers, as I have recommended. The barley was a good crop, and the clover and rye-grass were probably equal to the first year's cut of hay. The second year the artificial grasses began to fail; worse the third, fourth, and fifth; the sixth year, after having received two dressings, the spontaneous product of the soil began to give a fleece over the surface of the

land. About ten years after these lands were sown, I saw this field, when the part sown in August was worth at least fifteen shillings per acre more than the part which had been sown with artificial grasses in the barley. Thus from actual experiments, numbers of which I could adduce, I conclude that sowing the sweepings of hay chambers in August, is preferable to sowing artificial grasses in the spring with any crop of corn. Suppose the corn worth five pounds per acre, the difference in the produce of hay or feed in the second, third, fourth, and fifth years, would more than counterbalance this; and the proprietor would find a permanent improvement in his land of from fifteen shillings to twenty shillings per acre.*

Many object to sowing such rubbish as the sweepings of hay chambers produce; and I wish, most sincerely, any method could be devised for procuring clean seeds of our best, and natural meadow-grasses. It is a great desideratum, and premiums to encourage agriculturists to save seeds of the fescues and poas, &c. and for the largest quantity of land sown with these seeds, and kept distinct, might be of infinite service. Until this can be effected, the plan I have submitted to you, my Lord, appears to me the most eligible. It certainly has been crowned with the greatest success. Sowing rubbish in August, is not of so great importance, as in the spring. In the former season, all the annual seeds vegetate, and if the beginning of the winter be mild, they will blossom; but they cannot perfect their seed, and the first frost destroys them. If sown in the spring, they vegetate, blossom, perfect and shed their seeds, and thus stock the land with noxious weeds. The facts I have stated must do away the objections to sowing rubbish. It is immaterial what you sow, if you do but obtain an abundant crop, and leave your land clean, and in good order. Should it, however, be thought proper to sow the seeds with any corn, barley must have the preference. If sown with oats, and the land be prepared as it should be, viz. in high tilth and order, the oats will be so luxuriant, as to smother and destroy the young plants. Lands, intended for grass or meadow, cannot be in too high a state of cultivation. The permanent improvement in the intrinsic value of the land, will abundantly repay almost any expense. To improve the soil with this view, and then to exhaust it by a crop of corn at the time of sowing the seeds, appears to me a sure method of counter-acting the very

* Had the barley been drilled, horse and hand-hoed, and kept perfectly clean until July, and then sown with the common hay-seeds, the only objection to the plan would arise from exhausting the soil by a crop, when your great and leading object is to make a permanent improvement.

object in view. I have always advised the landlord to provide the hay-seeds, that he might be sure, not only of the quality, but that the quantity should be sown. Indeed, as the improvement is a permanent one, if the tenant make a good fallow and dress the land well previous to sowing the seeds, or directly after earthing the hay, he does his proportion. On these terms I have permitted many tenants to break up grass lands, on their covenanting to lay them again, in a specified number of years, preparing the land by a complete highly-pulverised fallow, and sowing the hay and other seeds of the landlord's procuring, the first week in August; and after the first crop of hay, to dress the lands with twenty loads of good dung, or compost, per acre, if the soil was of such a quality as not absolutely to require dressing previous to sowing the hay-seeds. A dressing before sowing, or after carrying the hay the first year, is absolutely necessary.

The additional rent must be regulated by the quality of the land, from ten shillings per acre, to fifteen and twenty shillings. If the land be naturally very sterile, and difficult to till, as in the Wilds of Sussex, and the tenant be obliged, by paring, burning, and fallowing, to purchase his first crop very dearly, no additional rent should be required; but he should be tied to such a judicious mode of cropping as would leave the lands in an improved state for the landlord: see the Table at the end. If the land, after being drained and marled, will produce a good crop of oats with one effectual ploughing, the tenant may pay an additional rent of ten shillings per acre. Where the lands will produce a good crop from one effectual ploughing, without the expense of draining and marling, the rent may be advanced fifteen shillings per acre; and on lands naturally very good, a landlord may expect an additional rent of twenty shillings per acre for every acre of grass land he may allow to be converted into arable.

The depth at which grass lands should be at first ploughed, must depend upon the nature of the soil. In my directions for improving sterile clays, I have, I trust, proved the utility of moving such soils to a great depth. Similar observations will apply to all clayey loams, where the surface and the substratum consist of the same component parts. On deep rich loams of all denominations, deep ploughing will be advantageous; but when there are only four or five inches, or less, of good earth, and the under stratum be a rubbly chalk, gravel, or other unproductive soil, it should never be brought to the surface; and being naturally pervious to water, it will not require being moved below the action of the plough.

In my practice, I have almost invariably mown the grass the first year, and immediately dressed it well, and fed it the second. My success, in every instance, has been great, and no inconvenience ever arose from this system. In some few cases, I have seen much injury arise from feeding the first spring: the lands being in a high state of cultivation in August, and the surface kept very light by the frosts and fleece of grass, the cattle have pulled up the young plants by the roots, and entirely destroyed them. The Duke of Richmond's Bailiff was very desirous to feed the young grasses, before-mentioned, in the spring; the flock wanted the food, and there was an abundant crop. So urgent was the man, that the Duke, who had promised that my directions should be implicitly obeyed, wrote for my consent; but to this plan I positively objected, declaring, that should the stock be allowed to feed the lands the first spring, I would not answer for the success of the experiment. His Grace, who is always firm on such occasions, would not therefore give his consent to his Bailiff's request. The result of the experiment was such, that neither the Duke, nor his Steward ever regretted adhering to my advice.

Answer to the Query respecting feeding on the Land, or carting to Sheds.

On these subjects I can also speak from actual experiment. Born and educated in Suffolk, where almost all the turnips are fed upon the land, I naturally adopted the same plan. Experience has since convinced me, that though the Suffolk farmers may know how to grow good turnips, they have yet to learn how to make a proper use of them. The objections to this system are evident. A large proportion of the turnip crop is wasted by the cattle. The manure is not only very unequally and promiscuously left on the land, but by far the greater part of it is dropped, or washed into the furrows, and carried off by the rains; and winter feeding in this climate, without any shelter from the vicissitudes of the weather, must in some degree, injure the cattle. The only objection to carting the green vegetables home to sheds, both in winter and summer, is the additional labour and expense; but these are paid for in a ten-fold degree by the increased value of the food, the thriving of the cattle, the making the dung under cover, and having reservoirs to catch the urine. With this management, one good acre of turnips will produce an excellent dressing for an acre and an half of land, and will completely winter-fat an ox of fifty score. If fed on the land, two

acres may fat an ox, but not so well, and the dressing will be very partial and precarious.

But as your Lordship and the Board wish to derive information from actual experiment, I will give you the average money-price of an acre of turnips, to be fed on the land in Suffolk, and then state the profit, not of one acre, but of all the turnips on a farm when carted into sheds. Forty shillings an acre is a high price for turnips in Suffolk; but as they are fed in that county, very commonly, by the stock of graziers, who have no land, we must value the manure left on the field, though in a most slovenly way, at thirty shillings more. Now I have frequently cleared ten pounds ten shillings per acre by my turnip crop, when used in sheds; and a neighbour of mine, who farms on a large scale, cleared this sum on his whole turnip crop the last year; and the quantity of the very best manure raised from such an acre of turnips so managed, will amount to twenty tons, worth five shillings per ton. These observations apply to horses, and cattle of all sorts, sheep excepted. How far it would be practicable or eligible, to house these useful animals, I cannot presume to say; but certainly they thrive best when they lodge dry. Horses, bullocks, cows, &c. of all sorts should, in my opinion, be under sheds, winter and summer; except a few hours in the day time in winter, and a few hours in the evening, or at night, in summer. One acre of grass, clover, lucern, or vetches, cut and carted to the sheds, will support three times as many cattle, in better order than the same acre when fed in the common way. The waste in this mode must be great; from the trampling of the cattle; and on pasture lands, they will naturally pick the most palatable grasses first, and leave the others to run up to bents. No mixture of cattle can prevent this; for though one sort may prefer one species of grass, and another another, it is altogether impossible, so to proportion each species of cattle, to the species of grass most palatable to it, as to prevent a scarcity of one sort, and an abundance of the other. It must also be observed, that when there is a mixture of cattle, they frequently interrupt each other, and do not thrive. By stalling, all the green food is eaten, and no part of it wasted. The cattle fill themselves in half the time, and have more hours for rest. They cannot interrupt each other. The dung made under cover is not only much stronger, and in much larger quantities, but can be applied to any part of the farm, instead of being almost entirely lost, as when dropped on the pastures. The cattle are never liable to kick each other, or to be damaged by breaking pasture, and it will never

be necessary for a ploughman to lose a day's work, searching the adjoining fields or parishes for his horses. These experiments and arguments, will, I trust, appear conclusive as to the best mode of applying green vegetable food both in summer and winter. For my horses I have erected cheap thatched sheds, in which they have room to walk and to roll, and in these they go winter and summer; to which I attribute it, that they are not so liable to cold as those kept in a hot stable, and are never cracked or greasy healed. For my bullocks and cows my stalls are seven feet wide, each stall holding two head of cattle, each fastened by the neck close to the side of the stall to prevent their interfering with each other with their horns.

On the Management of Peat.

These lands, consisting of dissolved and half-dissolved vegetable substances, are wonderfully productive. To give the Board a proof of this assertion, I will state some facts which I procured from, I believe, undoubted authority in the fens near Wisbeach, two years since; when I valued a very large tract of these lands for Sir Henry Peyton, my friend Lord Rous's nephew. We will suppose the lands to have been two years in clover, thistles, and weeds, as is usual in that country. The first operation is to burn-bait. There not being a stone in the soil, they skim the surface with great ease with a skim plough, burn it, and spread the ashes, and then, with one shallow ploughing, cover the ashes, and sow wheat: usual crop five quarters per acre. The second year, they sow oats, and the common produce ten quarters per acre; the third year oats again, with a somewhat inferiour crop; with these they sow clover, and when I was in that country, after these three crops of white corn, the clover and thistles were so high, and so stout, that it was with some difficulty I could ride through the field. This clover is allowed to remain a second, and sometimes a third year, and then the same process is repeated. With this wretched system of cropping, the produce, as your Lordship and the Board must see, is very great. In these soils, nothing is requisite but a judicious rotation of crops; for this I will refer you to the table at the end of this Essay. Some care is also necessary in burning the soil, for which I will refer you to the chapter on burn-baiting.

On Paring and Burning.

On this subject agriculturists have differed very much in opinion, and on this subject I must offer your Lordship, and the Board, opinions, rather from theory than practice. I trust, in my chapter on the management of cold wet clays, where the surface and substratum only differ in quality, from the one having been exposed and tilled, and the other not, I have shewn that the paring and burning would be useful, provided the substratum was moved deep enough after the operation. In such soils no injury can be sustained by this practice. The same observation will apply to all soils with a depth of good mould previous to your finding a hungry gravel, a rubbly chalk, or any cold clay impregnated with a mineral. In burning peat, care must be taken not to let the fires be too powerful; as by injudicious management in a dry season, when the ditches are empty, these soils have continued burning for many weeks to a great depth, and so as materially to injure the land. With this precaution, no soils can pay better for paring and burning than these; as the operation of paring costs very little, and it is a very efficacious dressing on the spot, and the same soil continuing for some yards or rods below the surface, it is an inexhaustible fund of vegetable food. On all thin-skinned lands, where the substratum is really unproductive, paring and burning must be injurious. It is true you cannot by fire consume the soil, but you may change its quality. The calcareous matter you will convert into lime, and the clay into a brick earth; but this brick earth is void of all vegetable food, neither is it so good a nidus for the roots of plants, or so retentive of water as the clay. The depth of soil on the surface will be reduced; and though the brick earth, by acting mechanically on soils, where a sufficient quantity of clay remained for it to act upon, might be beneficial, yet in a thin-skinned soil, to convert all the clayey particles into brick earth must be prejudicial. Liming on such lands would increase the surface, and add to their fertility, but from paring and burning, though a crop or two may be procured, yet the soil will be materially reduced and injured.*

Having thus endeavoured to answer all the queries which your Lordship and the Board selected as objects most worthy of your premiums, chiefly from actual

* The expense of paring and burning is from twenty shillings to thirty shillings per acre.

experiment; permit me to offer some few observations on the advantages attending the new mode of husbandry, with directions for drilling and horse-hoeing corn. On these subjects also, I shall speak from fourteen or fifteen years experience on various soils, and in very different parts of the kingdom, on a large scale.

On the Advantages of the new or horse-hoeing System of Husbandry, with an Account of a drilled Crop of Barley and Lucern.

The most evident advantages from drilling, horse and hand-hoeing, arise from the savings in seed-corn (which in the present scarcity and dearth of every grain must more than equal the rental of all the arable lands in the kingdom;) from the seed being distributed with mathematical exactness, and at equal and any given depths; increase of crop; extirpating weeds; and from the superiour state of tillage and fertility in which the lands are left for future crops, absolutely precluding the necessity of summer-fallowing. This last advantage must be restricted to lands once cleared from quitch grass by a summer-fallow. To all annual weeds the drill farmer may bid defiance. So many experiments have been made to prove the superiority of this system, and published in various works of repute,* that I should not trouble your Lordship and the Board with what may appear superfluous, did I not find a mistaken prejudice operating on the minds of some partial drillers; who approving of the system in general, object to the use of it where barley and artificial grasses are the desiderata. From many many years practice, I am convinced that the most certain method of obtaining a crop of clover or other grasses without injury to the barley, is to sow the lands previous to the last horse-hoeing. The advantages of this method I have experienced by long practice, and they seem confirmed by theory. The barley being twice horse or hand-hoed, previous to sowing the seeds, will not only be clear from annual weeds, but a fine tilth will be obtained for the seeds; the blades of corn meeting over the intervals will protect the young plants from the depredations of the fly, and from the scorching sun; the moisture of every dew will be retained under the shade of the corn, and the seeds, by being sown a month or six weeks after the barley, will never exhaust themselves too much the first summer, nor rise so high as to interfere with harvesting the barley. In a moist season, when the seeds are sown early with the barley, the land is

* See Bath Papers, and the New Farmer's Calendar.

frequently full of annual weeds; the young plants of clover are often taken off by the fly; and if they flourish, expend themselves so much, that when you expect a full and first crop of clover, you have something like a second year's cut; and many fields of barley have been rendered useless for all the purposes of malting, by having so large a portion of rich succulent clover in the crop as to prevent their being harvested.

But as some doubt whether so large a crop of barley can be obtained by drilling, with intervals of a foot, as by broad-casting, I shall trespass on your Lordship's time, by giving you a statement of an experiment made the last summer, with such accuracy, that all the facts can be attested upon oath, if necessary. In 1799, I put a field, soil a strong loam, on to three feet ridges. In June of that year, I carted fourteen loads of long straw dung, spread it in the furrows of those ridges, and with one bout of the plough covered the dung, and formed the ridges over the furrows. On these I planted cabbages two feet and an half from plant to plant, and three feet intervals. These were ploughed between, horse and hand-boed, and the crop a very good one. By Christmas I had cut and carted the cabbages. I then levelled the ridges, and ploughed the land across them seven or eight inches deep, with two horses, and a common Suffolk plough. Early in the month of April, 1800, I harrowed the land across, with Mr. Cooke's fixed harrow, the driver standing on the harrow, and pressing the tines four inches into the soil. A few surface weeds appearing, I skimmed the land, without turning a furrow, with the scufflers, followed with a roller; and then with the fixed harrow, loaded as before, in a different direction, obtained a garden tilth five or six inches deep, as far as the frost had penetrated; below which, the loam was wet and cold. From this land I obtained eight quarters one gallon of barley, weighing fifty-five pounds each Winchester bushel; and two tons three hundred and thirty-three pounds of straw. But as I was determined to ascertain the money produce of my barley, I disposed of the whole crop, though I never before sold a load of straw.

	£.	s.	d.
Seven quarters and an half of best barley, sold at four pounds four shillings, - - - - -	31	10	0
Four bushels of dross sold for - - - - -	1	1	0
Two tons three hundred and thirty-three pounds of straw sold for	5	10	0
* Produce of the acre	38	1	0

I will also state the trifling expense of tillage for obtaining this produce ; estimating every horse employed at two shillings per day, and every man at the same rate of wages.

First ploughing per acre, by two horses - - - - -	0	6	0
Harrowing per acre - - - - -	0	0	9
Scuffling - - - - -	0	1	0
Rolling with a five foot roller - - - - -	0	0	9
Harrowing - - - - -	0	0	9
Drilling - - - - -	0	0	9
Harrowing to cover the seed - - - - -	0	0	9
Scarifying the corn, first operation - - - - -	0	0	9
Second ditto - - - - -	0	0	9
Horse-hoeing - - - - -	0	0	9
Rolling twice, after the corn was scarified - - - - -	0	1	0
	0	14	0

The tillage to have only prepared the land for a crop of barley in the most approved method in Hants, would have been,

Two ploughings with four horses, a man, and a boy, at eleven shillings each per acre - - - - -	1	2	0
The seed earth, with three horses, a man and a boy - - - - -	0	9	0
Carried forward	1	11	0

* The produce of the whole field was at least equal to the acre which was measured ; as a collateral proof of this, the tithe-owner refused three guineas per acre for the tithe of the barley, exclusive of the straw.

					£.	s.	d.
Brought forward	-	-	-	-	1	11	0
Three times dragging	-	-	-	-	0	3	0
Rolling once	-	-	-	-	0	0	9
Sowing seed	-	-	-	-	0	0	3
Harrowing, to cover ditto, with light harrows	-	-	-	-	0	0	6
Rolling once with a light roller	-	-	-	-	0	0	6
Expense of tillage, in the usual method	-	-	-	-	1	16	0
Three bushels of seed per acre, at the present price of barley	-	-	-	-	1	11	6
Expense of tillage and seed	-	-	-	-	3	7	6
In the new husbandry tillage	-	-	-	0	14	0	
Seed six pecks	-	-	-	0	16	9	
						1	9
Advantage in tillage and seed in favour of the new husbandry, per acre	-	-	-	-	1	17	9

It should also be considered, that the quantity of barley I usually drill upon an acre is one bushel, but being apprehensive, from the wetness of the preceding harvest, lest the seed should not all vegetate, I drilled six pecks. These, my Lord, are facts, and facts are stubborn things. I will leave your Lordship, and the Board, to determine whether a broad-cast crop, would have exceeded the produce of eight quarters which I obtained, only observing, that the same land never before in the memory of man yielded more than four quarters per acre. I have also at this time five acres of lucern between the rows of the barley stubble, which promises to be a very fine crop; nothing can be more regular or beautiful than it is at present. This was drilled after the last horse-hoeing, five pounds of seed per acre; and so protected were the young plants by the shade of the barley, and so constantly moistened by the dews, that they suffered nothing from thirteen weeks dry weather. This experiment seems to corroborate my arguments in favour of drilling, or sowing seeds, after the corn is considerably advanced in its growth.

An Account of the Instruments alluded to in this Essay.

The instruments alluded to in this Essay are, the common Suffolk plough without any wheel, worked by two horses and one man : this implement is too well known to require a description. Mr. Cooke's drill is an instrument, which will deposite any quantity of seed per acre, at any given depth, with Intervals of nine, eleven, or eighteen inches, two, three, or four feet, with mathematical exactness ; so that wherever it should fail of success, the failure must not be attributed to a defect in the machine, but to the ignorance, or more frequently the obstinacy, of the person who works it. I have tried it with success in all soils, except where there are large rock stones ; but were I obliged to declare in what soils the utility was most apparent, I should, without hesitation, say in strong clays, and clayey loams. To obtain a fine tilth on the surface of the soil, in the spring of the year, when the plants are growing, is indispensibly necessary. This, should an incrustation be formed by heavy rains, and sudden droughts, may at all times be secured by the use of the fixed harrow, scarifiers, and hoes. The cultivator is another instrument for which the agricultural part of the nation is indebted to the ingenious, and very superiour mechanical knowledge of the same gentleman. It consists of a diagonal beam with seven narrow shares, and when used with these it is called a tillage scarifier ; there are also five broad triangular shares, which may be fixed in the same beam, and with these it is termed as euffler ; the whole complete forms the cultivator. The scarifier may be used with three, four, or seven tines, or teeth, according to the cleanness or foulness, the looseness or tenacity of the soil. It is calculated to pulverize the soil, and to cleanse it from quitch grass. In short, it in a great measure supersedes the necessity of the plough. In tilling land, the objects are to pulverize, to expose, to cleanse from weeds, and to ridge up for keeping the land dry and healthy, and for sowing. These are the desiderata, and all of these, except the last, may be most completely attained, at half the usual expense, by the use of the tillage scarifier. To secure a garden tilth on the fallows without much expense, scarify the stubbles twice, deep and well, soon after harvest ; with half a ploughing lay the land on to three feet ridges before Christmas ; reverse them in February, and after barley-sowing sled or harrow down the tops ; roll and scarify alternately until you have a very highly pulverized soil, seven inches deep.

Form your three feet ridges, and drill your turnips. The scufflers, or broad shares, are to skim the land, and destroy the surface weeds. The fixed harrow is also a most excellent instrument, and, without the use of any other implement, will prepare land that was ridged up before Christmas for any spring-corn crop. It pulverizes the surface which has been exposed to the frost four or five inches deep, without turning up the cold sterile land below that depth.* All these instruments may be considered as appendages to the drill, all may be applied to the same axis and wheels, and as all of them are worked and directed by handles, by more or less pressure the depth may be regulated at pleasure. As I have been applied to by many gentlemen, from various parts of the kingdom for information as to the number of these instruments, and horses requisite to cultivate any given quantity of land, I shall take this method of stating to the Board my ideas on this subject. For keeping one hundred acres of arable land in high tilth, and regularly cropped, five horses would be necessary, two Suffolk ploughs, one cultivator complete, one beam and handles, with only the tillage scarifiers, one fixed harrow, and one drill with corn scarifiers, and a set of flat hoes. I should also recommend two pair of wheels with axis, independent of the drill wheels, which I would never use but for the purposes of drilling, except on very particular occasions. It is unnecessary to say, that one strong waggon, and one light harvest ditto, with three dung-carts would be necessary, one common pair of harrows, and two rollers, (one very heavy, and only five feet long to follow the scarifiers,) and one common roller for passing over the corn in the spring of the year. Though an instrument, not alluded to in this Essay, I should strongly recommend Mr. Cooke's chaff cutter, with which I cut almost all the straw raised upon my farm, which is applied to the purposes of animal food, and by passing through the stomachs of the beasts is converted into strong manure; one load worth three such as is usually made in yards, which is little better than wet straw. I derive great advantage also from a boiler invented by Mr. Cooke, which saves two-thirds of the fuel. By a tub over this boiler, I steam seven four-bushel bags of potatoes or turnips with three pecks of coals. A thrashing machine capable of being removed easily from one barn to another, appears to me a desideratum. The quantity of corn which might be saved by a complete machine of this sort would be of real national importance. Though the

* The scarifying harrow is admirably calculated to pulverize crops in an early stage of their growth, as it will pass in the nine or eleven inch intervals without injuring the plants.

cultivator and fixed harrow may be considered as appendages to the drill, yet they are applicable to the broad-cast husbandry, and would save, if generally used, more than half the common expense for tillage.

Upon Drilling and Horse-boeing.

Drilling is an operation which requires but very little attention. On this subject I shall only state the depth at which the seed should be deposited, the quantity per acre, and the width of the intervals, which appears to me, after fourteen or fifteen years practice, to be the most eligible. Many crops of wheat have been greatly injured by depositing the seed too deep, especially in wet soils: a little attention to the principles of vegetation will demonstrate this. Nature is uniform in her operations, and whether the seed be put into the earth at four, three, two, or one inch below the surface, the roots, which are to carry the corn to perfection, will be formed at one precise depth, and very near the surface. Wheat has two sets of roots, which may be termed the seminal and coronal; the first come from the grain, and the others are formed in the spring from the crown of the plant; they are united by a tube of communication, by which the plant is supported until the coronal roots are formed. By depositing the seed too deep, it frequently perishes by a superabundance of moisture; and certainly from its increased length, this little thread-like tube is more liable to be cut asunder by the red, or wire worm. This theory is confirmed by practical observation, for in the spring of the year I have frequently taken up plants of broad-cast wheat, and always found that those which appeared most luxuriant had been covered by not more than an inch of mould, and those which had fallen into the furrows, and were three or four inches below the surface, had a very sickly appearance, with a small blade of a bad colour, and making no efforts for tillering. From this theory, strengthened and confirmed by observation, I conclude that an inch is the best depth for depositing the seed of wheat. The same observations will apply to oats, barley, and rye, all plants which form their coronal roots near the surface. I should recommend wheat, barley, oats, vetches, and rye, on soils not very wet, to be drilled on five or ten feet ridges in equidistant rows of one foot. Beans, pease, and turnips on three feet ridges, two rows on a ridge, nine inches from row to row, with intervals of twenty-seven inches. Lands in high tilth, and on five feet ridges, will require only three pecks of seed wheat

or rye; five pecks of oats, barley, or vetches, and one bushel of beans or pease per acre, and half a pound of turnip-seed on the three-feet ridges, varying a peck an acre, according to the goodness of the seed, and the richness of the soil. For scarifying and horse-hoeing, some attention and judgment will be requisite. No corn should be scarified until the spring of the year. Pulverize the surface by passing the fixed harrow across the wheat previous to scarifying, to break the incrustation on the surface, lest the scarifiers should throw large flakes of earth over the rows of corn. After this operation, pass the scarifiers through, about an inch below the surface; returning in the same track, as deep as the land was ploughed; then roll with a heavy roller, which will give the whole land a concussion, and pulverize it six inches below the surface, allowing the tender roots room to expand in a fine bed of vegetable food. In short, care must be taken not to throw any earth up to the plants in this early stage, for as nature always forms the coronal roots at the most advantageous depth below the surface of the soil, by throwing earth to the plants you impede her operations, and she will, by a sort of vegetable instinct, be obliged to form fresh coronal roots. I have known the progress of vegetation much retarded for want of this precaution, and nature has laboured so steadily to rectify the errors of man, that sometimes three sets of coronal roots have been formed, those beneath dying, as the joint at the proper distance below the surface sends out new ones. When these operations are performed with judgment, the advantages are beyond calculation. The scarifiers and roller moving all the soil, without earthing up, give the roots room to expand, and assist the operations of nature; the tillering will be greatly increased,* and all the offsets ripen at the same time; and by earthing up the plants, when the ears are risen six or seven inches above the surface, a plump and fine sample will be secured, and no more offsets can be formed. Rolling will be injurious when the ears are risen above the surface. These precautions are only necessary with wheat, and the white corn crops, with coronal roots; with pease, beans, vetches, and all tap-rooted plants, no injury can be sustained for want of such attention. I shall therefore add two general observations applicable to all grains and soils. Never attempt to perform any of these operations until the land be dry, and be sure to keep a fine tilth on the surface of your lands four or five inches deep in the spring, whilst the plants are in

* I have counted one hundred and one stems of barley, all likely to arrive at perfection, from one seed.

a young and growing state. Were this new system universally adopted, the saving in seed corn would be of the utmost national consequence, certainly not less than eight million bushels of wheat, one million bushels of rye, three million bushels of barley, four million of oats, and one million of pease and beans. This statement does not amount to the full quantity which might be saved. This last autumn more than a sixth part of the scanty crop of wheat was thrown into the ground for seed. Such are the times, that the noblemen and gentlemen of landed property must considerably increase their rents, or they cannot hold their situations in the scale of society. To answer this demand, and the additional expenses upon every agricultural instrument, the rise of poor rates, and the high price of labour, the farmer must receive at least one-third more from the produce of his farm. Should this be effected by such an additional price on the articles of necessary consumption, the wages of our manufacturers must be such as to oblige us to give up all competition in foreign markets, and our trade will decline. But I am thoroughly convinced, that the landlord may enjoy his increased rent, and the farmer not only eat the fruits of his own labours, but acquire a competency for his family, by an improved method of husbandry without any increase on the average price of the necessities of life, taken for ten years previous to these seasons of dearth. These, my Lord, you and the Board will feel to be subjects of the utmost national importance. In a letter to the Bath Society, I affirmed that the saving of seed-corn, by the general use of drilling, would amount to five million pounds sterling annually; and that by the increase of crop, and a judicious application of that crop, particularly of the straw, which, when good, is preferable to bad or indifferent hay, an addition to the produce of the lands now in cultivation might be made to amount, with the seed corn saved, to fifteen million pounds sterling; and so careful was I not to exceed the bounds of truth, that I am fully persuaded my calculation is below what might be effected by one half. May the laudable exertions of such patriotic noblemen as yourself, and your intelligent predecessor, Lord Somerville, be crowned with success; and may our agricultural improvements, and internal resources, keep pace with the increasing demands which the necessities of the times must occasion!

A comparative Estimate between Grass and Arable Lands.

Though I have demonstrated by actual and extensive experiments, the advantages resulting from a judicious mode of converting lands exhausted by tillage into meadow and pasture, yet I do not allow that lands under tillage for any number of years, must necessarily be in such an exhausted state as to make this plan requisite. On the contrary, I am fully persuaded that all lands capable of cultivation, will, if well tilled, fairly cropped, and dressed, be in a progressive state of improvement, and not only produce a better rent to the landlord, and pay twenty times as much to the productive labourers, but also yield a much greater profit to the occupier than the same number of acres in grass. Fine rich meadows on the banks of rivers liable to be flooded, and such as can be irrigated, no one would think of converting into tillage, but all grass lands from ten to thirty shillings per acre rent, I should wish to see tilled by judicious agriculturists. It is not necessary to give validity to my opinion by an exact detail of the produce of grass lands and arable lands of the value to which I have confined my assertion. If grass lands let for ten shillings per acre, yield the gross sum, on an average of years, of seventeen shillings, there is so very little expense upon them, the tenant could not complain. If let for twenty shillings, thirty shillings may be the gross produce. If for thirty shillings, let forty-five shillings be the average. As rates and taxes advance with the rents, probably this may be a fair estimate. In a national point of view, how can these sums be equivalent to those which must be produced from arable land, when every agriculturist is convinced, that the expense of labour only on every acre of land well cultivated, will amount to more than three pounds by the time its produce is carted to market. Whilst therefore these lands continue to pay the farmer for his additional trouble, skill, and capital, it is evident the national produce must be increased. But some gentlemen apprehend such a preference to the plough would increase the price of butcher's meat to an alarming height. To this Mr. Adam Smith would answer, that wheat will ultimately regulate the price of all the necessaries of life. I have full faith in the conclusion drawn by this able writer; but as a farmer, I can obviate this objection without resorting to his authority. Take this course of husbandry on lands worth thirty shillings per acre, turnips, or cabbages, oats, clover, and wheat. The eighth part of an acre of good

turnips steamed, and with the liquor mixed with oat straw cut, will keep a full-grown beast in good order six months. An acre of turnips, with the first crop of clover hay, will fatten two bullocks in the same time. The wheat-straw, with the addition of one-eighth of an acre of turnips, will winter another beast; and the second cut of clover another. Thus the produce of straw, turnips, and clover, from the four acres, with the addition of one-fourth of an acre of turnips, will keep three beasts six months, and in the same time will fatten two bullocks of fifty score each. The produce of four acres of grass land let at thirty shillings per acre, would not send two fat bullocks to the market, and summer two. If I be correct in my statement, which I trust I am, the advantage in favour of the arable lands is more than the whole of the crops of wheat and oats. Gentlemen and farmers who have not tried the effect of steaming the potatoe and turnip-crops, and stalling all their cattle, may suppose my calculations erroneous, but my own practice confirms the theory. The quantity of rich manure raised will pay the additional labour. I am aware that the estimate of productive labour should not be restricted to the farm, and that the cattle, or the sheep, after they are disposed of by the grazier, find employment for our manufacturers. But the advantages, derived from this, do not more than counterbalance the sums expended in manufacturing the produce of the arable lands, after it is carted to market by the grower. The wheat is turned into various sorts of flour, starch, and hair-powder. The barley into malt, beer, and spirits. I have therefore omitted the expense and profit on the produce both of grass and arable lands, after it is disposed of by the farmer. My statements, from actual experiments, which constitute probably the most material part of this Essay, your Lordship, and the Board, may depend upon as correct. Should my theory on other subjects, of the utmost national importance, appear erroneous, it will be disregarded; but, I trust, with this indulgent conclusion, that the author's wishes to be of service to his country, far outstrip his abilities; and that, bowerer, light and superficial his arguments, when weighed by the scale of superior knowledge and more extensive information, may appear, no one will doubt the purity of his intentions.

I have the honour to be, &c.

THE AUTHOR.

To the Rt. Hon. Lord Carrington, &c.

A Table showing at one View a Course of Crops adapted to various Soils for any Number of Years.

Clay - - -	{ Turnips or Cabbages }	Oats	{ Beans and Clover }	Wheat	{ Turnips or Cabbages }	Oats	{ Beans and Vetches }	Wheat
Clayey loams - -	{ Turnips or Cabbages }	Oats	Clover	Wheat	{ Turnips or Cabbages }	Barley	Beans	Wheat
Rich loams, or Sandy loams - -	{ Turnips and Potatoes }	Barley	Clover	Wheat	Beans	Barley	Pease	Wheat
	Beans	Barley	Pease	Wheat	Ad infinitum			
	Turnips	Barley	Clover	Wheat	Potatoes	Barley	Pease	Wheat
Peat earth - -	Turnips	Barley	Clover	Wheat	Potatoes	Barley	Pease	Wheat
Chalky substratum	Turnips	Barley	Clover	Wheat	Potatoes	Barley	Pease	Wheat
Gravels - - -	Turnips	Barley	Clover	Wheat	Potatoes but on this soil ten acres in every hundred should be laid with sainfoin for 8 or 10 years.	Barley	Pease	Wheat
Lightlands - -	Turnips	Barley	{ Clover and Rye grass }	{ Clover and Rye grass }	Clover and Rye grass	Pease	Wheat or Rye	

This course of husbandry is only recommended on condition that the crops are all hoed well, and kept perfectly clean; and that the turnips, pease, and beans be put in double rows on three feet-ridges, and the cabbages in single rows of three-feet ridges.

Days.	OCCURRENCES.	Men.	Women.	Boys.	Horses.	HOW EMPLOYED.
April 28th, Monday.	Delivered Eighteen Baskets of Oats out of the Granary.	12	9	6	10	Two Men and four Horses ploughing the first field in — lane. Three Men and six Horses scuffling and harrowing the further field. Two Men turning up Dung in Billy Barn Yard at —. Two Men cutting Hay and Straw, looking after Oxen and Cows, at Ditto. Two Men and one Boy Ditto, at —. Nine Women turning Potatoes at —. Two boys keeping hards. Two keeping Cows. One Boy pulling Turnips. One Man carrying 4 casks.
Tuesday.						
Wednesday.						
Thursday.						
Friday.						
Saturday.						
Sunday.						

No. VII.

Essay on the Conversion of Grass Lands into Tillage, &c. by Mr. Thomas Davis, of Longleat.

To the President and Members of the Board of Agriculture.

THE writer of this Essay begs leave to submit, with deference, his opinion on the very important subject of "making a temporary Addition to the Tillage Land of the Kingdom." He assures the Board that this opinion is founded on an extensive practice of near thirty years, and on a minute observation of the practice of others, in a large portion of the kingdom. He has long thought the subject to be of very great national consideration; and having frequently observed how little the principles of it were understood, he has thought it his duty to be very particular (perhaps too much so) in explaining those principles, preparatory to his giving rules for practice; and he hopes on that account to stand excused for the length of the Essay.

THE number of laws on the Statute Books, particularly from the reign of Henry VII. to that of Queen Elizabeth inclusive, to prevent tillage land from being converted to pasture, is a sufficient proof that the quantity of land in tillage in this kingdom has long been supposed to be on the decrease. The frequent repetition of those laws shews that they were broken or evaded, and the surveys of landed property in this kingdom, in the sixteenth and seventeenth centuries, afford a very sufficient reason, viz. that the yearly value of meadow land compared with that of arable, was frequently as ten to one, eight to one, six to one, and seldom less than as four to one.

Various laws have been made to encourage tillage, and always have been evaded.

reasons why.

Consumption of the produce of grass land has progressively increased,

as has also the price of those productions.

The introduction of turnips, &c. has tended to supply the uses of grass land;

and tillage lands adapted to that culture, have advanced in price.

The rent of old meadow lands has been thereby kept down.

The value of the productions of grass land has increased, more than the value of wheat.

Wheat has increased but little in price since the seventeenth century, till very lately; of course the rent of wheat land has not advanced in proportion to that of other land; Reasons why.

Reasons why wheat did not increase in price.

The consumption of the productions of grass lands must have increased very considerably since the Reformation, by the increased demand for butcher's meat, in consequence of the abolition of fish days, without adverting to the increased (or supposed increased) luxury of modern times. The price of those productions has certainly increased in a much greater proportion than that of corn, (particularly wheat,) and it may fairly be presumed that they would have borne a much higher price, and of course more tillage land would have been converted to grass at this time, had not the introduction of artificial grasses, turnips, and other green crops raised on tillage lands, not only supplied the uses of grass land, but enabled the land-holders to supply the markets with fresh meat during the whole of the winter, in a manner which it was not possible to have done by grass and hay alone. Tillage lands, that were adapted to this particular culture, have, consequently, advanced rapidly in annual value, and more particularly in countries where meadow land is scarce, until their value has almost equalled the value of meadow lands, while the old meadow lands (where local advantages of situation do not exist) are let very little higher than they are stated to have been, at the time of taking the parliamentary survey, one hundred and fifty years ago.

Notwithstanding the addition to the animal food of the kingdom by this great improvement in agriculture, the prices of the productions of grass land have progressively increased, while the average price of wheat was little, if any, higher during the first ninety-four years of the eighteenth century, than it was in the century preceding; and, of course, arable land, whose depending production is wheat, has not advanced in price in proportion to arable land applicable to other purposes. The productions of grass land, being in their nature perishable, vary in price according to the crop of the year; and as the supply of those articles depends, almost entirely, on the produce of the kingdom, unassisted by importation, the price has always kept pace with the produce, and the grower has suffered but little injury from a defective crop. Wheat, on the contrary, will keep uninjured for some years. The deficiency of one crop has been supplied from the surplus of former years, and whenever it was dearer here than in other countries, importations from abroad have again reduced the price to its level; and the corn-farmer (and particularly the

where the farmer) has not had the advantage, like the grass-farmer, of selling his defective crop, at a proportional increased price.

It therefore follows, that the fears of famine, in consequence of the continued decrease of the tillage land of the kingdom, were for a long series of years unfounded, or at least that the injury (if it be allowed to proceed from that cause) was not felt till the year 1795, and that all the laws, against the increase of grass land, would have been, if fully carried into effect, injurious to the landholder, and, of course, to the public.

If it were a fact (which it is not, and so will be proved hereafter) that the kingdom cannot supply an increased quantity of corn, without diminishing the quantity of its animal food, it need not an argument to prove, that the latter must give way to the former. But it is sufficient to state here, what is now generally allowed, that it does not at present produce bread-corn sufficient for the consumption of its inhabitants; and, after giving the reasons why the produce of this article should have fallen so materially short within the last few years, to point out the most practicable, effectual, and speedy remedies.

Many causes have, undoubtedly, contributed to the present scarcity of wheat. The most obvious are:—First, The great quantity of land, particularly strong wheat land, laid down to grass within the last twenty years, and that for the best of all reasons, viz. that the price of wheat has not advanced in proportion to the price of every other production of land: Secondly, The great proportion of defective crops, or bad harvests (not less than six in the nine years ending with 1799) which has gradually decreased, and now entirely exhausted the old stock, and left us under the pressure of a defective crop in 1800, to the chance of a foreign supply to avert a famine: Thirdly, A population rapidly increasing.—It is not for man to presume, that a succession of bad crops may not happen again; but as far as is in human power, we may obviate a future similar calamity, by removing the first cause above assigned, viz. the deficiency of wheat land, by converting a sufficient part of grass land to tillage, whereby the supply may not only be equal to the present consumption, but sufficient for an increased population. If we can prove that it is the interest of the landholders to do so, all difficulties will vanish, but this must be proved, before an alteration will take place to any efficient extent; and this is the object of the present Essay.

As wheat did not increase in price, the fears of famine, from the decrease of tillage land, were groundless when those laws were made.

The kingdom does not at present produce bread-corn sufficient for its consumption.

Reasons for the present scarcity of wheat.

How to be relieved for the future, viz. by increasing the quantity of tillage land,

and that without injury to the landholders.

To prove that it is possible to convert grass land to tillage without injury to the landholders, it will be positively necessary to prove, that any land will yield a higher rent in a state of tillage, than the same land would yield in a state of meadow or pasture, because the fact has hitherto in general been supposed to be otherwise, or the complaint of the decrease of tillage land would not now have existed.

Much Land, particularly fit for wheat, has been laid down to grass; and the value thereof much improved thereby:

reasons why.

Much land late in pasture has been tilled, and the value thereof much increased, and much yet remains to be done.

Light lands, recommended to be broken up, are peculiarly adapted to the modern husbandry.

It is a fact that thousands of acres of deep strong land peculiarly adapted to the growth of wheat (particularly in the Vale of Evesham, and most of the midland counties) have been doubled, trebled, and even quadrupled in value, by being laid down to grass. No temptation, not even the fixing a *fair minimum* on the price of wheat, (a much more politic measure than fixing a *maximum*,) would make it worth the owner's while, to suffer them again to be broken up. The increased prices of horse labour and manual labour; the uncertainty of a season for tilling such land; its inapplicability to almost any other purpose, but that of growing wheat and beans; and its peculiar aptitude to make the best meadow land, are sufficient reasons why land of this description is of little comparative value in a state of tillage. But it is also a fact, that very large tracts of land in this kingdom which were covered with furze or heath, or at best, were in a state of coarse unprofitable pasture, have been converted by means of inclosures to good arable land; and there are thousands of acres of old inclosed pasture land of similar quality, which nature never intended for pasture, and which ought to be in tillage. Lands of this description are certainly worth a much higher rent in a state of tillage, than in pasture, as they are particularly adapted to the improved modes of husbandry, and will, over and above the quantity of grain to be produced from them, produce a greater quantity of vegetable food for animal stock when in a tillage state, than they did when kept entirely in pasture. And it is necessary that as much land of this description as possible should be converted into tillage; for if it were admitted that the quantity of pasture land already converted to tillage is equal to the tillage land laid down to grass, still the growth of wheat in this kingdom would nevertheless be considerably reduced, as the lands laid down were in general the best wheat lands, whereas those broken up are chiefly light lands, and of course but occasionally cropped with wheat.

In the infant state of agriculture, meadow land being scarce, and of course desirable, bore a much higher rent than tillage land. The disproportion has been gradually decreasing by the modern improvements in husbandry. But because it was once right to restrain tenants by heavy penalties from ploughing up any grass lands, the same covenants are still indiscriminately inserted in leases, without regard to soils, circumstances, or situations; and this has been the reason why much land is retained in pasture, which would have been, and ought to be, in arable. It having frequently happened, that grass lands have been very much reduced in value by being converted to tillage, a landlord, who is not a sufficient judge to know whether the proposed conversion be right or wrong, always supposes that a tenant must have interested views in recommending it, and therefore rejects the proposal, and inserts a covenant to prevent it in future; and the consideration, besides, that corn-farms require much more expensive buildings than grass-farms, is no small stimulus in favour of the latter. There are undoubtedly some descriptions of land which ought always to remain in grass, and if they are now in tillage, ought to be turned to grass, viz. First, Lands near large populous towns, where manure is cheap and plenty, and where the produce of grass land is always in demand, and consequently dear: Secondly, Lands situate near rivers or brooks, that may be improved by irrigation to a much greater value, than can possibly be done under any other mode of culture: Thirdly, Lands lying in the valleys of mountainous countries, (particularly chalky soils,) where old meadow land is scarce and valuable, and the greater part of the arable land is of that nature, that it is next to an impossibility to convert it to good grass land: And, fourthly, all cold strong grass lands which, if ploughed up, would be inapplicable to the growth of turnips, and to the general purposes of modern husbandry; and which, under the best system of wheat husbandry, would not be so valuable as they are now in a state of grass. In fact, all may be summed up under this general rule, *that all land should be kept in that state, in which it will yield the greatest permanent rent to the owner.* Whatever kind of husbandry is for the interest of individuals, is, collectively, for the interest of the public.

Having now shewn what descriptions of land ought always to be in a state of grass, it remains to shew what descriptions of grass land may be profitably

Reasons why no more grass-land has been converted to tillage, although the value might have been much increased thereby.

Description of the lands which ought to remain in grass.

What lands ought to be in tillage.

converted into tillage, either to remain permanently in arable, or as a temporary expedient with intent to restore it to grass again uninjured, as shall be found best for the interest of the landholder, and to point out the best modes of husbandry for the attainment of those objects.

Difficulty of restoring land, when ploughed, to grass again unimpaired.

To convert grass land to tillage, and that with profit to the occupier, requires no particular rules or directions. But to restore that land again to grass unimpaired, is a difficulty not always to be surmounted. It is well known, that land, which has been long in a state of grass, has acquired that degree of fertility, which will enable it to produce successive crops of corn without manure. It is therefore evident, that the production of corn exhausts in a few years those principles of fertility, which the land in a state of grass had been for a long series of years acquiring.

Solution of, and remedy for, this difficulty, a great desideratum in agriculture.

To restore those principles when land, so exhausted, is again to be laid down to grass, or to prevent their exhaustion during the time it is in a state of tillage, is the great *desideratum* in agriculture. Were this secret once known and reduced to a system, the prices of the different productions of land would soon find a general level.

This difficulty does not attach to all soils.

When grain was dear, grass land would be ploughed up; when it was too cheap to pay the expenses of cultivation, the land would again be restored to grass. In some parts of the kingdom this is commonly and easily done. The land having a natural tendency to grass, will, when left unploughed, revert to pasture without labour, expense, or even seed. In others, all the art of man has been found insufficient to make grass land. After twenty years fruitless expectation and expense, the landholders have frequently been obliged to restore the land again to a state of tillage.

Discrimination of soils, proper for grass land, highly necessary.

The great difficulty is therefore to discriminate what species of land is proper for grass, and what is not. The best meadow land does not always make the best tillage land, nor does the best arable land always make the best pasture; but frequently the reverse.

Necessity of inquiring into the process of nature in propagating and perpetuating grasses.

To make this discrimination, it is necessary to consider well the process of nature in propagating and perpetuating grasses. The great object of nature is to perpetuate all her species; but upon the plants created for the support of animals intended for the food and use of man, she seems to have bestowed more than ordinary care. Different kinds of animals propagate

in different modes, some oviparously and some viviparously. Plants having no locomotive motion, are endowed with a power of propagating in both modes. In trees and shrubs, and many kinds of plants, the assistance of man is required to obtain viviparous production, by grafting, budding, &c. But in grasses, nature does her own work, and that in both modes. We have only to attend to her examples, and we shall seldom err.

This process explained.

In trees and shrubs, the bud is the viviparous production; in grasses the root performs the same office. Grasses are as much the offspring of roots, as of seeds. Every new root contains the germ of a future plant; and as the seed-stalks of grasses must necessarily be frequently cropped by animals, nature makes up the deficiency by an increase from the roots. Most of the best grasses are in their nature biennial, but nature, by giving them the power of propagating by the root, has in effect made them perennial: a much more certain mode of propagation than by seed, as being increased, instead of being injured by the biting and treading of animals, and by the produce being perfect in one year, instead of waiting two, as in the production by seed! But this process does not go on successfully unless the land is peculiarly apt for the production of grasses. If it is too wet, the grasses will be injured in the winter by rain and frost, and will soon be superseded by rushes and other aquatic plants: if too dry, they will be killed by the summer's heat, and give place to mosses, fern, heath, &c.

Land intended for grass should be such in which it will spontaneously thrive and flourish.

No land will make a good meadow, unless it is deep enough to admit the roots of grasses to run down out of the reach of the summer's heat, and that it be retentive enough to hold water just so long as to produce fermentation, with such an absorbent substratum as will drain it, before putrefaction takes place; and if it is not so by nature, and cannot be made so by art, ploughing will make it worse. If land is too wet, it must be drained, if possible: if it cannot, cultivation is thrown away upon it, and a state of tillage will make it more wet. If land is too dry and friable, ploughing will make it more so. Grass land of this description should therefore never be ploughed, unless it can be made retentive by fossil manures, obtained on or near the spot, such as lime, chalk, clay, or, above all, marle. Where either of these can be had at a moderate expense, and where it has been observed not only to produce good crops of grain, but

Land fit for the purpose described

to promote a tendency in the land to run again to grass, it is a sure sign it is the proper alternative for the land: and as a state of tillage is in general the most proper for the application of these manures, all light land that can be so manured should be ploughed up, and, after being kept a few years in tillage, (particular care being taken not to exhaust it by corn-crops,) may be laid down again to grass in a much better state than it originally was.

Directions for the choice of land to be broken up, with intent to be restored to grass again.

To sum up the whole in one general remark; let it be an object of attention to all landholders who propose to convert grass-land to tillage, to be careful that there is in the land an aptitude to run to grass again; * and particularly to remark what is the proportion in rent between grass land and arable land on similar soils in the same country. If the difference is very great, as two to one, or even as three to two, in favour of grass land, it is a strong symptom that arable land, in that country, is not easily laid down to grass. But if the difference is but as four to three, or still more inconsiderable, ploughing the land can do it but little injury, and may be of great service to the occupier as well as to the community. And if it is possible by the use of fossil manures, to make arable land of more value than grass land, then ploughing becomes indispensable, and the landholder is unpardonable who neglects it.

Summary of the foregoing observations.

The design of all these observations is to shew—First, That some kinds of grass land may be converted into tillage, and again returned to grass, without injury, and in some instances, in an improved state: and, secondly, to point out general rules for discriminating what lands are most proper for that purpose.

Object of this Essay is to explain the principles, as well as to detail the practice.

The writer heretofore hopes he has been successful in this attempt, and if so, he will be justified in being the less particular in the subsequent detail of the management of land proposed to be converted from grass land to tillage, and again from tillage to grass, because if the theory is right in itself, and is well understood, the practice founded on that theory is much

* The writer does not mean to insinuate that the earth produces any plants spontaneously, but that either the roots or seeds of natural grasses will remain for years in land peculiarly favourable to them, in spite of all tillage, and will vegetate and flourish as soon as the land is left untilled.

less likely to be wrong, than when carried on without attention to any fixed principles. Under this idea he has thought it right, first to offer general observations on the different descriptions of land pointed out by the Board, and after shewing which are, in his opinion, most fit for convertible husbandry, to describe the modes of management which he has found in his own practice, or observed in the practice of others to have been successful.

The leading qualities of land as particularized by the Board, are as follows:

I. Clay, in all its Distinctions, and Soils too strong or too wet for Turnips.

This description of land is the most unfavourable of any for a state of tillage. It is in general more valuable as grass land. If too wet, it may be drained much better in a state of pasture than in tillage. Its great fault is, that the soil is too retentive of water, and ploughing will make it more so, especially if (as is frequently the case) the top soil is not deep enough for the plough, and the raw clay is brought up from beneath. When ploughed, it is certainly, in general, good land for wheat; but this (as has been already explained) is the least profitable of all crops to a farmer, and particularly in heavy lands; and not being applicable to turnips or any other improvements in husbandry, it will never yield so high a rent in a state of tillage, as when in grass land. The expense of cultivating it, and its natural tendency to absorb manure when in a state of tillage, are such drawbacks upon its produce, that lands of this description have not increased in value in any proportion with light lands, in the last fifty years. An exception may here be made, where sea sand can be obtained as a manure for clay lands, and which is the usual mode of husbandry on the north-west coast of Cornwall. —See Appendix, No. I.

Clay land in general not fit for convertible husbandry.

Reasons why clay lands have increased so little in value.

Exception in favour of clay lands.

II. Loam of all Descriptions fit for Turnips.

These kinds of lands are of all descriptions the most proper for convertible husbandry, and may, not only without injury, but generally with benefit, be changed from grass to tillage, and again from tillage to grass, as is generally practised in Devon and part of Cornwall; in that part of

Loams, the best of all soils, for convertible husbandry.

Somersetshire which lies upon the marle veins, and in many of the midland and northern counties.

General mode of management.

It is impossible to detail the particular management of every variety of this land, as it depends entirely on local circumstances. But the great object is not to keep it in tillage too long, and while in tillage, not to have two crops of corn in succession; to use fossil manure where it can be got, and where it cannot, to manure as high as possible with dung when the land is laid down to grass. See particulars in the Appendix, No. II.

III. Sand, including Warrens and Heaths, as well as rich Sands.

Sands.

Poor sands not so proper for pasture as for arable.

This description of land, (particularly the poorer kinds of sand,) should never be kept in permanent pasture, unless particular local circumstances, such as vicinity to a great town, or a mansion house, may make grass land profitable or eligible.

Reasons why.

The improvements in husbandry which have contributed to the great advance in rents within the last fifty years, have chiefly taken place on sand lands, and many of them of the poorest kind.

Reasons why sand lands are now more valuable than formerly.

Arable lands of this description, which were formerly supposed not to be capable of bearing any grain but rye, (as the rye lands in Herefordshire) may now rank among the most productive lands in the kingdom.

The county of Norfolk has pre-eminently taken the lead in sand husbandry. Vast tracts of sand land in a state of coarse pasture, and not worth two shillings and sixpence per acre, have been ploughed and improved by the turnip husbandry to fifteen shillings per acre. And all lands of the same description that are capable of similar management, should not be suffered to lie in worthless pasture.

Fossil manures desirable in sand husbandry.

But it must be remarked, that the use of fossil manure, either lime, chalk, clay, or marle, is the *sine quâ non* of sand husbandry. Ploughing alone will make light sands lighter. Fossil manure must be applied as an alternative, to fix the staple of the land, and bear up the subsequent manures, and keep vegetation near the surface. See the Norfolk process—Appendix, No. III.

Rich sands, the richest of all soils, either for grass or

Rich sands (of all descriptions of land in this kingdom the richest) can seldom be applied to a wrong purpose. Whether in grass or tillage, they

will always answer the purpose of the occupier; but they are in general the best for convertible husbandry. And if marle can be had on the spot to be used when the ground is laid down to grass, as is the case about Frodsham, in Cheshire, this land is invaluable. See Appendix, No. III.

tillage, particularly where marle can be obtained.

IV. Chalk Land and Downs.

Chalk lands are in general unfavourable to natural grasses, and particularly where the chalk lies near the surface. They are so retentive of water, in the winter, and so very porous and pervious to the sun's rays in summer, that it is the work of an age to make a good pasture from land which has been once in tillage, and sometimes absolutely impossible. Wilts, Dorset, Hants, Bucks, and other chalk counties, furnish numberless examples of fruitless attempts of this kind.

Chalk lands.

Chalk lands unfavourable for grass, when once they have been ploughed.

The downs, or hilly parts of chalk countries, have seldom answered any great purpose under the plough. The soil being usually black, is too loose and too light for a state of tillage; and land of this description will not improve by chalking. Burabeating has been the general mode of manuring these lands. This has produced great crops for a few years, and then left the land a mere *caput mortuum*, not capable of bearing corn or grass. There are thousands of acres of land of this description in all the above-mentioned counties, which though not ploughed within the last thirty years, have scarcely a blade of edible grass upon them, but are entirely covered with the black benty couch (*agrostis stolonifera*) which no animal will eat; and the land is literally worth nothing.

Down lands, (such as the soil is black and loose) not much less so.

But on the tops of the hills there is in general a tract of strong red loamy land, approaching to clay, which is now, or was once, covered with wood. This land (in those cases where the wood is not worth preserving) will answer much better for tillage than for grass. There is generally chalk of the best quality under it, and no land improves more by chalking. Indeed it is so very sour from having been once wood land, that chalk is necessary to make it fit for the production of corn.

Exception in favour of red land on the downs.

Great improvements have been made on land of this description by ploughing and chalking. See Appendix, No. IV.

V. *Peat, including moory, sedgy, rough Bottoms, and Fens.*

Peat land must be put into tillage to improve it

Evidence of Dr. Anderson in favour of destroying the texture of peat.

Reasons why necessary.

Peat lands should ultimately be pasture.

The writer of this Essay has had less experience in land of this description, than in any of the foregoing; but from what he has seen, particularly in King's-Sedgmoor in Somersetshire, and Trafford Moss in Lancashire, he is convinced that peat land can never be so well improved, as under the plough. The ingenious Dr. Anderson has so fully explained the nature of peat in his Treatise on Peat-bogs, and shewn the necessity of destroying its texture and subdividing its parts, that the writer hereof is too conscious of his own inability to offer any thing on the subject.

It is evident, that land which only produces aquatic plants, can never produce edible grasses, until the latter are sown, and the former destroyed. This can only be done in a state of tillage. But when this object is once attained, lands of this description are in general best to remain permanently in grass; and when drained and improved, will frequently make the best meadows.

They are in general too tender for permanent tillage; a good coat of grass will make them firm enough to bear the heaviest cattle. And if there should be (as there frequently is) a vein of clay under the peat, no manure can be so cheap, and none is so proper for lands of this description. See Appendix, No. V.

APPENDIX.

Rules for cropping and managing Land, intended to be converted from Grass Land to Tillage for a Time, and then to be returned again to Grass Land.

No. I.—*Clay Land.*

THE only instance known to the writer hercof, of strong clay lands in a state of tillage, reverting well to grass, is on the north-west coast of Cornwall, where sea sand can be got within the distance of ten or fifteen miles: The soil is chiefly a strong clay, and the land is kept in constant succession of convertible husbandry. The practice allowed to be the best, is four years in tillage and seven years in pasture. The land having a natural tendency to run to pasture, will hold the ray-grass seven years, and about that period it is broken up.

Management of convertible clay land in Cornwall.

The process is to get as much earth as possible from the ditches or sides of the fields in the preceding winter, to mix that with stall dung in heaps under the hedges, turning and incorporating it together. About May the land is pared as thin as possible, the earth is shook from the turfs with heavy harrows, and the residuum, which is chiefly roots, is burnt; the ashes are spread over the land, as is the compost of dung and earth, and to this dressing they also add sea sand in the proportion of one hundred horse loads to an acre. When the whole is spread, the land is once ploughed, and after a certain time harrowed; and in October is sown with wheat, chopped in by hand, with mattocks, and afterwards harrowed.

This dressing is certainly very expensive, but it answers the farmer's purpose, or it would not be pursued. The wheat crop is usually followed by barley, then by turnips, and then by barley with seeds, viz. ray-grass mixed with small quantities of different clovers; but ray-grass is the depending seed, and will last seven years in the land, when the same tillage process is again repeated.

In the last described process, burnbeating is certainly a principal part of the manure; and however wrong this operation may be elsewhere, it is right here. The soil, though clayey, is dry; the sea sand mellows the clay, and makes it hold the grasses, and the soil, though clay, is not wet enough to retard their growth.

But there are in many other parts of the kingdom, numberless instances of wet cold clays, where burnbeating of grass land has been very injurious.

It has certainly enabled the land to produce corn for a time; but as soon as the stimulus excited by the fire has subsided, the land has been left unproductive as arable, and no art has been able to restore it again to grass.

No. II.—*Loams.*

It has been already stated that loams (particularly those that are good in their quality,) are the most proper of all lands for convertible husbandry. The term Loam comprehends such a variety of soils, (in fact all soils, except sand, clay, and peat,) that it is not easy to define all its varieties.

The writer hereof will confine himself to three leading distinctions, as having come immediately within his own practice or observation.

1. Red land, upon or near lime-stone.
2. Stone-brash land, upon or near marl.
3. And clayey loam, upon a real clay bottom.

The principal subdivisions of loams.

1st. Red land upon or near lime-stone.

Mode of management as convertible land.

The first description of land comprehends great part of Devonshire, part of Cornwall, and a considerable portion of Somersetshire. The husbandry is in general convertible; the land is limed, when broken up from a state of grass; the crops are various, and subject to no particular rules, even amongst the best farmers, but that of having corn crops and green crops alternately; feeding off the green crops with sheep or other cattle, so as not only to manure but tread the land as close as possible; and laying down to grasses, before the land is exhausted: the crops in which the grasses are sown, to be well manured, and the land when in grass to be fed hard, and trod close for the first two years, to encourage the growth of the roots of the grasses; and if manured again upon the young grasses, so much the better. Lands of this description, where lime can be had

within a moderate distance, and where the land will bear a repetition of lime (which is not the case on all soils) will be benefited, instead of being injured, by being occasionally changed from grass land to tillage. Indeed they should always be ploughed up, as soon as the appearance of mosses among the grass indicates that the effect of the lime is exhausted, and that a repetition is necessary.

Lime, the depending manure.

Whatever may be the occult qualities of lime, one of its visible qualities is certainly to fix land which is too friable, and by keeping vegetation near the surface, to encourage the growth of natural grasses, and prevent their roots from being burnt up by the rays of the sun.

Effect of lime on land of this description.

11. *Stone-brash Land.*

This description of land includes a large tract of land extending from the north of England through Warwickshire, Gloucestershire (the Cotswold Hills being almost wholly stone-brash) and part of Wiltshire and Somersetshire.

Loom, on a substratum of stone-brash.

Marle is the natural manure for this land, and there is a vein of marle under the greater part of this district; and although it has not been sought for in some places, and not much used in others, there is no manure whatever which can be applied so cheap, or whose effects are so permanent. Wherever it is used, grass land on a stone-brash soil may be very profitably converted to tillage, and again restored to grass, not only uninjured, but doubled, trebled, and sometimes quadrupled, in value.

Marle, the proper manure for this description of land.

This system of marling is carried to perfection about Radstock, in Somersetshire, and the neighbouring villages, and great quantities of land have been thereby improved from two shillings and sixpence to forty shillings per acre.

Where used with success.

A vein of marle lies generally within about ten yards of the surface, but this is rejected in favour of a better vein, which lies about six yards deeper.

The marle is got by sinking a shaft, and underworking the vein in the manner of a coal-pit; and the expense of landing it seldom exceeds one shilling per cart load. About thirty cart loads are sufficient for an acre.

How used.

Mode of cropping
when in tillage.

The process is to plough up old mossy grass land; to crop it with corn as long as it will bear crops, (without much regard to uniformity or propriety in the crops,) and to lay it down to grasses in a crop of barley or white oats.

Mode of laying
down to grass.

The grasses usually sown are—ray-grass, one bushel; marle-grass, alias cow-grass, ten pounds; white, alias Dutch clover, three pounds; hop clover, alias trefoil, one pound.

Process of marling
stone-brash land.

The grasses are sometimes mown, and sometimes fed the first year, and the marling process takes place about July. It is necessary that the land should be well covered with grass when the marle is laid on. If the grasses be thin, it is much better to feed than to mow them, not only the first year, but for one or two succeeding ones, until the marle is thoroughly dissolved and sunk into the land. If the surface be naked, the marle is apt to cake and plaister upon the land, and the summer's heat to burn up the young grasses. No natural grasses are sown, but they come up spontaneously, and those of the very best kind; and in about three years they will take place of the artificial grasses; and from that time for a space of near twenty years (and sometimes more) the land will be equal or superiour to the best native meadow land in the country, and frequently lets for forty shillings or fifty shillings per acre. In time, the marle sinks in the land below the reach of vegetation, the grasses decay, and mosses take their place; but the land, when again ploughed up, will bear several crops of corn previously to a repetition of marling, which is done in the same way as at first, and with equal success.

Much land capable
of this improve-
ment, neglected.

The writer hereof has thought it right to give this process in detail, as there is no description of land which may be so much improved at so little expense, and is so applicable to the purposes of convertible husbandry; and yet thousands of acres of similar land equally capable of improvement, as having the same vein of marle under them, are neglected, and are not worth five shillings per acre, either in grass land or in tillage. The writer has observed (and that with pleasure, as it was by his recommendation) that the practice is gaining ground on the Cotswold Hills about North Leach, and the improvement is astonishing.

No. III.—*Clayey Loams upon a real Clay Bottom.*

Deep loams of this kind are frequently used in convertible husbandry in the midland and northern counties, and the value of grass land and tillage land is so nearly equal, that the best turf is ploughed up without hesitation; and the land when laid down (if not exhausted with corn crops) will run naturally to grass, and in a very few years appear as if it had never been in tillage. In such soils, a great temporary increase of tillage land may be made without injury.

Clayey Loams upon a real clay bottom, in general favourable to the production of natural grasses.

In Shropshire, the practice is as follows, viz.; on heavy lands, to dung well with stall dung on the grass, in the summer previously to breaking up; to plough in February or March moderately deep; sow pease or oats; plough twice or thrice, and then a wheat crop; then barley (with two or three ploughings) in which the grass-seeds are sown, viz. Six pounds of red clover, six pounds white Dutch clover, and a peck of ray-grass seeds to an acre; and then to manure with a good coat of muck on the young grasses in March or April. On lighter soils, plough up for pease; then lime for a wheat crop; then fallow for turnips; and then barley with seeds, four pounds of red clover, eight pounds of white Dutch, and half a bushel of ray-grass, mucking well on the young grasses in March and April.

Mode of management in Shropshire, on heavy lands:

On lighter lands.

These grasses are, in two or three years, succeeded by natural grasses, and the land may, if required, be kept in permanent pasture, without having been injured by the ploughing. Indeed it is frequently improved.

Management successful in restoring natural grasses.

There is a tract of deep loamy land near Shaftesbury, in Dorsetshire, on the borders of Wiltshire, which has been improved wonderfully by being ploughed up, and again returned to grass. This soil has a substratum of clay, over a thick vein of blue marl. The country was once wood land, and the land, in a native state of pasture, is coarse and unprofitable. The practice is to marle previously to breaking up for wheat; to take two rounds of corn crops before laying to down seeds (Dutch clover and marle-grass) and then to chalk upon the seeds for a permanent pasture. This chalk is frequently fetched six or eight miles, and twenty loads or upwards put on an acre; and though the expense is of course great, it is amply repaid by the improvement.

Mode of management of clayey loams in Dorsetshire.—Coarse pasture ploughed up, first marled, then laid down to grass, then chalked, and left in a highly improved state for permanent pasture.

No. III.—*Poor Sand Lands.*

Poor sand land
improvable by
marle or clay :

Management and
effects.

Lime used for the
same purpose in
Wiltshire. Quantity
used and effect.

It has been already stated, that poor sand lands are less profitable as grass land than when under the plough. The poorest sands may be improved by marle, or even by clay, and converted into the most useful tillage land, as has been done on thousands of acres in Norfolk. The great object is to brace up and close the land, and to make, what is there provincially called, a pan under the soil, so as to keep up the moisture, and promote vegetation near the surface. The course of crops is well known. Turnips, and, above all, keeping the land clean from weeds, and avoiding exhausting crops, are the leading features of the system. On some of the poorer sands of Wiltshire, lime has been used with great success, as an alternative, in the proportion of twenty-five or thirty quarters to an acre. Its effect is the same as that of clay in Norfolk, that of closing and fixing the soil, and keeping vegetation near the surface.

No. III.—*Rich Sands.*

Rich sands proper
for convertible
husbandry manured
with marle in
Cheshire.
Crops and mode
of laying down to
grass.

These may be used in convertible husbandry to great advantage, and particularly where there is marle under them, as is the case with the deep, rich, red sands about Frodsham, in Cheshire. The practice is, first potatoes, secondly oats, and so alternately; and when the occupier is inclinable to lay it down to grass, it is sown with fourteen bushels of natural grass-seeds (from the hay lofts) and five pounds of white Dutch clover to an acre; and in the next year, it is marled from a pit dug usually in the same field. This manure will last twenty years, or upwards, and then bear a repetition with equal success. All lands of this kind can seldom be injured by being kept for a time in tillage.

In Wiltshire manured
with chalk.
Much land so manured
formerly.

The county of Wilts has a rich vein of sand land round the skirts of the Chalk Hills, of a tough retentive nature, and provincially called liver sand. Much of this land was manured with chalk fifty or sixty years ago, and though kept ever since in a state of constant tillage, and that of the most exhausting kind, still retains its fertility, and is (under turnip husbandry) the most useful and valuable land in the county. And yet (unaccountable as

it is) there are hundreds of acres still unchalked, many of them in unprofitable pasture, which, if chalked and converted to tillage, would improve to double their present value, the operation of the chalk on these sands (which are in general too firm and retentive of water) being to open the pores of the land, and to correct its acidity. But though the expense is not great, and the improvement is so obvious, yet very little of this kind of land has been chalked for the last twenty years. The causes of this neglect are well worth consideration.

much yet remains to be improved in the same mode.

No. IV.—*Chalk Lands and Downs.*

It has been already stated that chalk lands, when in a state of tillage, are not easily converted to grass-land, and that great part of the down lands in chalk countries, viz. all those whose surface is light and black, are in the same predicament; the former are too retentive of water, and the latter not sufficiently so: but that the red strong land, which frequently occurs on the tops of chalk hills, may be tilled to great advantage. Indeed this land is seldom very profitable in a state of pasture. Land of the latter description is generally of a good depth, but it is too close and retentive in its texture, and too sour in its quality, from having been once wood land, to be profitable in tillage, until it has been mellowed and sweetened by chalk.

Chalk lands, and much of the downs as are light and black, not fit for convertible husbandry.

Red land on the downs in a state of pasture, or unprofitable wood land, should be ploughed and manured with chalk.

Much land of this description has been chalked and cultivated to great advantage in the downs of Wiltshire, Hampshire, and Dorsetshire. The practice is first to grub up the bushes with which such land usually abounds, and then to chalk up on the surface in the autumn, and leave the chalk to dissolve before the land is ploughed, which will require at least one year, and sometimes two or three. The chalk is dug from open pits made on the same land, care being taken to go deep enough for the best chalk. The spreading is generally done with wheelbarrows, and sixteen barrows, (or about a cart load,) are put upon every square perch, viz. one hundred and sixty cart loads to an acre. The expense is seldom more than three pounds per acre, and the improvement is permanent. When the chalk is dissolved, a thin ploughing is given in November or December, and no other till June or July, when the land is clean ploughed to its proper depth, and sown to wheat in September.

Mode of chalking.

No. V.—*Peat Land, including moory, sedgy, rough Bottoms, and Fens.*

Peat land
in Somersetshire
improved by
ploughing and
claymng;
and in Lancashire
by ploughing and
marling,

in Suffolk by par-
ing and burning.

Reasons for put-
ting such land first
in fallage;

and ultimately in
grass.

The writer hereof has already stated that he has not had much experience in these soils; but he has seen great improvements made in King's-Sedgmoor, in Somersetshire, by ploughing up peat of this description, and manuring it with clay from beneath. He has also seen very great improvements made by Mr. Wakefield on Trafford Moss, near Manchester, by paring off the top surface (chiefly moss) to a great depth, and manuring with marle from beneath, the soil being so tender as to make the use of iron rail-ways necessary to carry out the marle: and he has heard of much greater improvements being made by paring and burning land of this description in Suffolk. In fact, whatever management and whatever manure will tend to destroy the top surface, and to make the soil firm enough for vegetation, is right: but as these must vary with local circumstances, no rules can be given that will apply to all cases. But the writer hereof is of opinion (as he has before observed) that although tillage is necessary to bring these lands into a state of cultivation, yet that the ultimate destination of the greatest part of lands of this description should be to grass, as soon as they are properly drained, and have acquired a sufficient texture to bear the treading of cattle without injury. Indeed treading is absolutely necessary to preserve the grasses in moory peaty lands, which will otherwise be liable to suffer by the summer's heat, and on that account it has been frequently observed, that nothing injures grass land of this description so much as mowing it, particularly in the first two or three years, after it has been laid down to grass.

ANSWERS to the General Questions proposed by the Board, or to such Parts thereof as have not been already answered in the foregoing Part of this Essay.

How long should land converted to tillage, with intent to be returned to grass, be continued under tillage; and with what crop of corn should the grass-seeds be sown?

Answer. Land, converted to tillage with no other manure than the dung of animals, should remain in tillage only one round of crops, viz. three years, or four at the utmost, of which only one crop should be wheat. But land manured with fossil manures as an alternative, not merely as a top-dressing, may remain in tillage two rounds of crops, of which only two crops should be wheat.

Light lands may be sown down with ray-grass mixed with such kinds of clovers as may best suit the land; but heavy lands, and particularly rich loams, have been frequently found to answer best when sown in autumn with natural grasses, in a wheat crop, with the addition of a few pounds of Dutch clover harrowed in, in the spring.

In what cases is it eligible to drain land previous to tillage?

Answer. A superabundance of water is undoubtedly very injurious to vegetation. Land, in a state of tillage, may be partially assisted by open furrows, and old grass land may suffer many years for want of draining, and yet be recoverable; but land intended to be converted from tillage to grass land, must either be dry by nature, or be made so by art, before it is possible to get a new crop of natural grasses. These must (as has been already explained) depend entirely on the roots they make. All the best kinds of natural grasses abhor a wet bottom when they are young, and will not root deep enough in it to bear the vicissitudes of seasons; and, not increasing by the roots as they ought to do, will die when they have perfected their seed, and leave the land bare. All wet land, that is intended to be converted from tillage to grass, should therefore be well drained if possible, and if it be not possible, it should never be put in a state of tillage.

In what cases are paring and burning advantageous ?

Answer. The success of paring and burning depends entirely on the nature of the land. Wherever the soil is already too light, and burning tends to make it lighter, as is the case on the Wiltshire Downs, it is evidently wrong. Wherever it tends to make light land heavier, or heavy land lighter, as is the case on the heavy clays and loams of Devon and Cornwall, and on the fen lands of Suffolk, Lincolnshire, &c. it is as evidently right. But in the particular instance of burning land intended to be returned again to pasture, it is indispensable to observe whether the practice has been proved in that country, to be favourable to the future production of natural grasses. On some soils it is so, on others it is the reverse.

To what depth should grass land be ploughed ?

Answer. Never lower than the natural depth of the surface soil. In some soils deep ploughing, although part of the substratum be brought up, may, in a state of tillage, be serviceable, as the influence of the atmosphere will in time reduce the substratum to vegetable mould, and will add a depth to the soil; but this should not be attempted in land intended to remain only a short time in tillage, as the substratum of almost all land is unfriendly to the growth of natural grasses.

Whether the crops intended for cattle and sheep should be fed on the land, and by which kind of stock, or carted off ?

Answer. On all light lands, treading is as necessary as manure, and all green crops should be fed on the land, except in wet weather. On all heavy soils treading is in general injurious; and from such the crop should be carted off. In fact, the nature and texture of the land should be well considered, and it should be treated accordingly, so as, if possible, to make light land heavier, and heavy land lighter.

Whether it be best to mow or feed the grass in the first year after laying down ?

Answer. Generally speaking, to feed it. Whether natural grasses are sown, or are expected to come up spontaneously, the dependance for a future permanent grass must be upon them, and not upon the artificial grasses. These grasses when young, root very shallow. Treading will make them flourish, as is the case in a

common foot-path. Mowing will loosen the soil, and give the sun an opportunity of burning them up, especially if the hay-making should be succeeded by a hot season. It is, however, necessary in feeding young grasses, to keep the cattle out when the weather is wet, especially if the land is tender.

On what principle ought an increase of rent to be estimated, where permission may be given to break up old pasture now under lease; in which question may also be comprehended, what part of the expense of manure and seeds ought the landlord to pay?

Answer. The tenant ought certainly to pay for the benefit he actually receives from the conversion, and no more; and if that benefit is not sufficient to repay the original expense, and subsequent loss, it will be folly to convert such land to tillage at all. This benefit must be calculated according to the duration of the lease. If the tenant is to reap the benefit of all the tillage crops, he should also bear the loss of the *interregnum* that will necessarily take place in the land, before it can be restored to a perfect state of grass; and there are few countries in which this can be calculated, until after the event. The only just mode between landlord and tenant, that will suit the duration of all short leases is, that the landlord should pay the expenses of seeds and of fossil manure, if such should be used; and that the tenant should be charged a rent to be settled every year by arbitrators, according to what the land would be worth to be rented for that year only; the management and cropping of the land to be under the direction of the landlord. But in leases where the term extends to as many years after the tillage is to cease, as the tillage is to continue, it will be fair that the landlord should pay the expense of extraordinary manure, and the tenant pay interest for it; and that the original rent should remain unaltered. All the other general questions are already answered in the detail of management.

The Writer hereof begs leave to assure the Board (in conformity to their request) that such part of the foregoing observations which relate to Wiltshire and Somersetshire, have been made from experiments in his own practice, or under his immediate direction, and that the rest are the result of accurate observation *on the spot*. He

sincerely wishes them success in this important inquiry, and it will be his great pride, if his humble endeavours should convey any information, or be in any degree useful.

If the Board should approve his general principles, but should be of opinion that he has failed in perspicuity of arrangement, he will think himself honoured by their commands to make such alterations as they may think necessary.

29th January, 1801.

No. VIII.

Essay on the Conversion of Grass Lands into Tillage. By the Rev. Arthur Young.

—VIRE ACQUIRIT FUNDO.

GENERAL PRINCIPLE.

IN inquiries upon any subject, it is necessary that an author should be possessed of as clear an idea as may be of the general principle that governs the object in view: there is some little obscurity in the present case; the common and usual principle to which a rational man would recur is, that of private interest leading landlords either to grass or corn, according to the respective profits by rent attending each. The requisition of the House of Lords to the Board of Agriculture implies, that there is, or may be, a distinction between the permanent conduct of individuals, and their true interest; and further, that what they find their own benefit, is not that of the public; and that they ought to be induced, by some means or other, to give up their interest in the present case in favour of another, viz. that of the people. Now, as this proposition, takes a most questionable appearance, the doubt probably arises from the subject not being thoroughly understood in certain great leading points, which should have some light thrown on them before I offer any observations on the topics specified by the Board.

Without pausing on the exceptions of certain individuals, perhaps every where to be found, it is reasonable to expect, that the great mass of landlords pursue their real interests; and when we see them very generally prefer grass to tillage, in every part of the kingdom, and take all fair opportunities of increasing it, whether by inclosure or otherwise, there must be some efficient circumstances which direct them. If these be weighty, and duly considered, neither the wishes of the Board, nor the efforts of the Legislature, will have any influence in changing their conduct.

CHAPTER I.

Of the external Circumstances that lead to Pasturage or Tillage.

By external are here meant such as are foreign to the qualities of soil: the principal of these are, the respective prices of the products of grass, and arable land; and speculations on those prices.

If the price of corn, during a period of many years, be found to be lower, on a fair comparison, than the price of meat, butter, and cheese, it is reasonable to suppose that the conversion of the soil (if any) would be to pasturage; always carrying along with us the fact, that grass products are gained at less hazard, and at less expense to landlords, than arable ones; which will have a certain influence in favour of grass, under every possible variation.

Now the fact has been, that from 1771 to 1794, being twenty-four years, the average price of wheat for all England was 5s. 8d. a bushel. We have no registers of the prices of meat, butter, and cheese; I must therefore assume a fact, in which I believe I need not fear contradiction, that the latter prices, whatever they might be exactly, were at least on the balance higher in proportion than wheat: the truth is, 5s. 8d. a bushel is much too low a price to induce any exertion in extending those efforts, which increase the product of corn.

Now let us examine where Parliamentary inclosures have taken place to 1797.

<i>Counties.</i>	<i>Acres.</i>				<i>Total Number of Acres in each County.</i>
Bucks	-	-	53	-	441,000
Leicester	-	-	135	-	560,000
Northampton	-	-	127	-	550,000
Lincoln	-	-	173	-	1,740,000
Rutland	-	-	18	-	110,000
Stafford	-	-	38	-	810,000
Warwick	-	-	69	-	670,000
			613		4,881,000

Conversion of Grass Lands into Tillage.

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<i>Counties.</i>			<i>Acres.</i>			<i>Total Number of Acres in each County.</i>
Bedford	-	-	31	-	-	260,000
Berks	-	-	27	-	-	527,000
Cambridge	-	-	7	-	-	570,000
Essex	-	-	3	-	-	1,240,000
Hertford	-	-	9	-	-	451,000
Hunts	-	-	27	-	-	240,000
Norfolk	-	-	53	-	-	1,148,000
Suffolk	-	-	8	-	-	995,000
Surrey	-	-	3	-	-	592,000
Sussex	-	-	4	-	-	1,140,000
172						7,163,000

Inclosures in the first series have had a pretty general effect of turning arable to grass,* and in the latter, of changing grass to arable. In the first, the acres are more than three times as numerous as in the last, though the district is little more than half as large. Hence the balance, without any doubt, will be found to prove, that for the last thirty years grass land has been gaining on tillage; and it highly deserves the attention of the Legislature, because it is a fact which should never be separated from that price of wheat I have quoted of 5s. 8d. a bushel; *affected in a great measure by importation*

But it may be said, that the price of wheat since 1794, has been much higher; why does it not, therefore, change grass to arable? Because men speculate on the future prices; and they speculate wisely. Very unfortunately, perhaps, the price of corn fell in 1797 and 1798, and for four months in 1799, to about 6s. a bushel, which I will venture to say is less than the farmer can now raise it for, with a profit to himself: that sudden fall proved to landlords how unwise it would be to enter upon permanent measures (for such in some respects breaking up grass must be esteemed,) in consequence of temporary variations in price. If the price of 1795 and 1796 had induced them to plough, what would they have said in 1797 and 1798? It is true, two high years have come since; but this does not prove that we shall not see wheat again at 5s. or 6s. a bushel; and what then will be the ideas of those

* It is not stated as a fact without exceptions; for, in Lincolnshire, certainly many inclosures favoured ploughing, and in Bedfordshire some turned arable to grass.

men who have been induced to plough large tracts of land well adapted to grass.* Such statements are of no use without the conclusion; which is, that the Legislature should, by a revision of the corn laws, secure the landlord from the apprehension of future prices being too low to compensate the farmer for his expenses, and himself for permitting tillage. This is easily done, and we may therefore hope it will be done.

CHAPTER II.

Of the Quantity of Human Food from Grass and Arable Land.

THIS I consider as another question which demands some attention, previously to entering on the main inquiry. It is extremely difficult to be ascertained with accuracy; but that ought not to deter us from such an examination, as the time allowed by the Board will permit. The subject cannot at present be thoroughly analyzed; but if a little light be thrown on it by every one who has turned his thoughts to such subjects, the Board may be able to collect from the whole something of importance.

But these inquiries suggest a further idea concerning the *part* of the produce, of either grass, or arable land, to which *that* circumstance is attached, and which we denominate *price*. It is evident, on the slightest view of the subject, that the *portion* of the produce consumed, in the *farmer's* family, can have little to do with the price of the *market*: it never finds its way thither: it never comes to be measured with the demand of the *consumer*; who does not produce. For this reason, in all inquiries that have for their object what is called plenty or scarcity, we never hear of any thing but *price*; and price is never formed but by the supply of towns from the *produce* of the country.

The larger part of a modern society consists of the inhabitants of those towns, who are supported either by manufactures, or on incomes not derived immediately from the cultivation of the earth.

So much for just opening our way in a field rather interesting: but may we not, with equal propriety, extend the circumstance just alluded to, to the labouring families supported by the farmer? His little neighbours in the village, who do the

work of his husbandry, arrest, if I may so express it, the amount of their subsistence from the crop before it arrive at the market. They must be fed; and though in many cases, by buying their flour of a miller, they seem to class with the inhabitants of a town, yet perhaps in more numerous cases they are, in fact, fed immediately from the farmer's stores; and in effect always so: for if the farmer cannot produce his crops but by their direct assistance, and must multiply them exactly in proportion to the oporoseness of his culture, they cannot be considered in any other light than mouths attached to the culture of the land, and demanding a deduction from the produce of wheat, before the surplus for market be reckoned, in as direct a deduction as that from his crop of oats for the food of his horses.

There are in the Suffolk Report some estimates of what the writer calls produce free in the market, and he makes the grass lands yield a greater free produce (horses, labour, &c. &c. deducted) than arable; and I know not but it may be the same in other counties. Other writers seem also to have had the notion that grass land is more beneficial than arable. Bertrand, a Swiss writer, says, that grass countries yield more food than arable, and therefore manufactures should be fixed in them. Hardib seems to be of the same opinion, and quotes those of Europe, as the most populous. Fortrey, who wrote in 1663, says, that our chief care should be to increase our stock of cattle. There is some degree of truth in these sentiments; and they might be considered in relation to the proportionate nourishment, in a pound of animal food, compared with that of a pound of vegetable, which some authors have made vastly greater in meat than in bread. These are topics which ought to be well examined, that the public mind may be free from every erroneous bias.

In the dairy countries, where butter is the chief produce, 4 firkins, or 224 lbs. may be reckoned the average produce per cow; the calf, sold at about a week old, may contain about 30 lbs. of flesh; and as the pigs supported by a dairy used to be reckoned at the rate of 20 s. per cow, when pork was 6 d. per pound, it implies, that 40 lbs. of pork is the proportion to each cow: but the cow consuming the produce of three acres, the acreable account would be,

				lbs.
In butter	-	-	-	74
In veal	-	-	-	10
In pork	-	-	-	13
Total	-	-	-	97

In the cheese countries the products vary a good deal: in Cheshire 4 cwt. per cow; in Shropshire $2\frac{1}{2}$ cwt.; in Gloucestershire about 2 cwt.; in Wiltshire 4 cwt.; in Somersetshire $3\frac{1}{2}$ cwt.; in Warwickshire 3 cwt.:* the average of all these is $3\frac{1}{2}$ cwt. and at three acres per cow, 1 cwt. and a small fraction per acre: and as these countries are richer than those applied to the produce of butter, veal may be called 15 lbs. and pork 20 lbs. in all 147 lbs. per acre.

As to meat, authorities are not very ample: in the midland counties there is a very general notion that an acre of grass at 4 s. rent, will give 200 lbs. of mutton. By an experiment made on land of an inferior quality, which is mentioned in the *Annals of Agriculture*, land of 16 s. rent gave 80 lbs.; and I have heard, on good authority, that in Cambridgeshire some observations carefully made, confirmed this proportion of produce in land fed both with bullocks and sheep; and the produce of beef, &c. in the Lincolnshire marshes, goes even further than this ratio.

The butter dairies are on land of about 16 s. an acre rent; and if the produce be 97 lbs. the proportion will be 6 lbs. to every shilling rent.

The cheese dairies, at 25 s. rent, yielding 147 lbs. are also at about 6 lbs. per shilling rent. The meat is 5 lbs. per shilling. It is easy then to decide, that dairy countries are more advantageous than grazing ones in weight of produce; but their superiority is far greater in another point of view; their produce comes much more into the consumption of the poor; for, where one poor person eats meat, there are probably forty that consume butter and cheese.

How to compare these products with those of arable land is very difficult; and yet the inquiry is too interesting entirely to be omitted: a long train of investigation might enable one to disentangle difficulties, but it would require much time to go deeply into such a variety of subjects.

The produce of a good loamy soil, under the course, 1. Turnips, 2. Barley, 3. Clover, 4. Wheat, may be thus calculated:

* See Mr. Marshall's Glouc. Econ.

No. I. *Arable dry Land at 16s. an acre rent, five acres each crop; 20 acres in all, in a course of four years husbandry.*

1. Turnips; * eight sheep an acre at the increase of 5s. each sheep, or 40s.; in mutton 80 lbs.; and for five acres 400 lbs. will be sufficient (at $\frac{1}{2}$ lb. per person † *per diem*) for two persons, one year, and five weeks

Persons. Time.
2 1yr. 5wks.
2. Barley and oats; suppose an allowance of $1\frac{1}{2}$ acre of oats (at five quarters per acre) for one horse as the proportionate team to 20 acres, and including seed for $1\frac{1}{2}$ acre: in all 60 bushels; ‡ remain $3\frac{1}{2}$ acres for barley, at four quarters an acre, 14 quarters or 112 bushels; deduct 14 for seed, remain 98 bushels for malt, &c.: but, if applied in bread, sufficient at nine bushels per head § *per annum*, for 11 persons a year, minus one bushel
3. Clover: deduct two acres for the summer and winter food of the horse, remain three acres for sheep, at eight per acre, improved 8s. each, or £ 3. 4s.; or (at 6d. per pound) 128 lbs. ¶ of mutton, and for three acres 384 lbs. sufficient at $\frac{1}{2}$ lb. a day for two persons a year; and leaving 20 lbs. over; 2 1yr. 20dys.
4. Wheat; 22 bushels per acre, which, after deducting seed, leave 20, or $2\frac{1}{2}$ quarters, and for five acres 12½ quarters, sufficient for 12 persons a year and two weeks - - 12 1yr. 2wks.

Whole produce in human food

16 1yr. 17dys.

The same land, if in grass, would give 80 lbs. ¶ of mutton per acre, 400 lbs. *per annum*, and for four years 1,600 lbs.; sufficient at $\frac{1}{2}$ lb. a day to support eight persons one year and 36 days

8 1yr. 36dys.

* Turnips fattening eight sheep an acre is a common estimate in Norfolk and Suffolk, and the average improvement in each sheep of 5s. is equally common.

† Merely assumed It is easy for those who would calculate on a different quantity to do it for themselves.

‡ Fifty-four bushels for the horse, six for seed.

§ The common consumption in the countries where barley is eaten.

¶ It is before stated that natural grass of 16s. an acre rent will give 80 lbs. of mutton; clover upon land of the same rent will of course produce much more.

¶ According to the position just laid down with respect to grass land.

But from this result we have to make the deduction, before alluded to, of the farmer's family, and his labourers; suppose he farms 100 acres, which is, probably, above the average size of farms of the kingdom, here are five persons to that extent, or one to 20 acres.

If we reckon all sorts of labour at 21s. an acre, we shall not be far from the fact: the pay of a labourer may be reckoned on an average at £25. which we shall call the food of five persons; setting the earnings of the wife and children against rent, clothes, and other articles; this makes food £5. a head: for every £5. therefore that the farmer pays in labour, we may safely reckon that one person is fed from the produce of his farm before it reaches the market: the labour in the 20 acres in the above inserted estimate being £21. I call four persons, and the farmer's family one, making five, to be deducted from the arable amount.

					<i>Persons.</i>	<i>Yrs.</i>	<i>Days.</i>
Brought down	-	-	-	-	16	1	17
Deduct	-	-	-	-	5	0	0
Remain for market	-	-	-	-	11	1	17
and the 20s. excess in the £21. strikes off	-	-	-	-	0	0	17
					11	1	0

In regard to grass land, as it is managed with so much more ease, and farms are generally so much larger, I think it will be fair to deduct only one person for farmer and labour.

					<i>Persons.</i>	<i>Yrs.</i>	<i>Days.</i>
Brought down	-	-	-	-	8	1	36
Deduct	-	-	-	-	1	1	36
Remain for market	-	-	-	-	7	1	36

Hence then it appears, that under the circumstances of such land thus applied, arable land, on comparison with grass, sends to market in the proportion of 11 to 7 $\frac{1}{3}$.

But if the barley, instead of being drunk, be eaten in bread, it adds to the arable account 11 persons, and the account would then stand nearly 22 to 7 $\frac{1}{3}$, or about three to one.

But the largest part of the kingdom is employed in systems of husbandry very inferior to this excellent one. Let us calculate how the comparison will stand with open fields, and those inclosures, which are managed by means of fallows in the ordinary rotation.

No. II. *Open-field Arable—Soil clay or wet—Rent 10 s. an acre, five acres each crop; 30 in all, in a course of six years husbandry.*

1. Fallow :
2. Wheat ; produce 22 bushels ; seed two ; for consumption 20, or $2\frac{1}{2}$ quarters ; $12\frac{1}{2}$ quarters for five acres, being food for 12 Persons. Time. persons during one year and two weeks - - - 12 1yr. 2wks.
3. Oats : produce four quarters an acre ; seed half a quarter ; remain $3\frac{1}{2}$ quarters per acre, or $17\frac{1}{2}$ quarters, or 140 bushels : sufficient at 25 * bushels a head, to feed five persons a year and five weeks, if used in bread
4. Fallow :
5. Barley ; supposed to be consumed in beer, &c. : but if eaten by man ; at four quarters an acre, deducting half a quarter for seed, remain $3\frac{1}{4}$ quarters or 28 bushels ; and at nine bushels a head, sufficient for three persons one year, and one bushel over, and five acres enough for 15 persons one year and two weeks -
6. Beans ; for horses equal to the food of $1\frac{1}{2}$ horse (at one horse to 20 acres) for the year

12 1yr. 2wks.

The same land laid down to grass, and let at 20 s. will feed (on the supposition of an increase 5 lbs. per shilling rent) oxen and sheep to the addition in weight of 100 lbs. of beef and mutton, or 500 lbs. for five acres, and 3,000 lbs. in six years ; which, at half a pound a person *per diem*, or 182 lbs. per head *per annum*, will feed $16\frac{1}{4}$ persons a year.

The course here detailed does not feed the horses in summer, but, as it affords

* Smith, in the Three tracts on the Corn Trade, calculates at 23 bushels : I think it safer to allow 25.

perhaps more horse food in the beans than to that amount, no other deduction should be made. It appears that 30 acres of such land, when the oats and barley are eaten by horses, or drunk by men, support 12 persons a year and two weeks; now from this we are to deduct, as in the former case, the population of the farmer and his labourers; the former in the same ratio as before; but 15s. will be enough to deduct per acre in labour, instead of 21s. in the other course. This will on 30 acres be £22. 10s. or $4\frac{1}{2}$ persons a year: add one and an half* for the farmer, it is six in all.

						Persons.	Yrs.	Wks.
Brought	-	-	-	-	-	12	1	2
Deduct labour and farmer	-	-	-	-	-	6	1	0
Remain for market	-	-	-	-	-	6	1	2 †
The grass	-	-	-	-	-	$16\frac{1}{2}$	0	0
Deduct $1\frac{1}{2}$ for farmer and labour, that is one per 20 acres	-	-	-	-	-	$1\frac{1}{2}$	0	0
Remain for market	-	-	-	-	-	15	0	0

But if the barley and oats be brought into the account as human food, the account will then stand thus:

						Persons.	Yrs.	Wks.
Wheat	-	-	-	-	-	12	1	2
Oats	-	-	-	-	-	5	1	5
Barley	-	-	-	-	-	15	1	2
					say	32	for 1	2
Deduct for farmer and labour	-	-	-	-	-	6	1	0
Remain	-	-	-	-	-	26	1	2

In one case therefore the grass has the advantage as 15 to 6: in the other, the arable as 26 to 15.

* The same proportion as before, one to 20 acres.

† This subtraction is of persons only, the time remaining the same.

No. III. *Poor sand or beat*—Rent 5 s.; five acres each crop; 30 acres in all.

Persons. Yrs. Wks. Days.

1. Turnips: four sheep an acre, to the increase of 6 s. each, or 24 s.; in mutton 48 lbs.; and for five acres 240 lbs.; sufficient at $\frac{1}{2}$ lb. *per diem*, for one person one year, 16 weeks, and four days - - - - - 1 1 16 4
2. Barley and oats; one horse to 30 acres, which demands $2\frac{1}{2}$ acres of oats, at three quarters (seed deducted) the remainder therefore $2\frac{1}{2}$ acres for barley, at $2\frac{1}{2}$ quarters per acre, being 16 bushels (seed deducted) and for $2\frac{1}{2}$ acres 40 bushels remain for malt; but enough in bread, at nine bushels a head for $4\frac{1}{4}$ persons a year, minus one bushel.

3. Grasses.

4. Ditto.

5. Ditto.

The whole without any horse account would feed,

1st year three sheep per acre 26 weeks

2d two ditto ditto

3d one ditto ditto to the improvement
(or the value in keeping) of 40 s. and for five acres in each to £ 10.; hence it appears that to keep one horse would almost equal the whole amount

6. Rye: $1\frac{1}{4}$ quarters; 12 bushels; seed deducted, 10; sufficient to support one person 15 months; and for five acres six persons one year, and eight weeks - - - 6 1 8 0

Within a small fraction equal to

8 1 0 0

The same land in heath would feed, but not fatten, to the value of 10 s. per acre; call this 20 lbs. of mutton; 100 lbs. for five acres, and 600 lbs. in six years; sufficient at $\frac{1}{4}$ lb. *per diem*, for three persons a year and 36 days - - - 3 1 6 1

	<i>Persons.</i>	<i>Yrs.</i>	<i>Wks.</i>
Brought, arable account	-	-	8 1 0
Deduct, as farms on this soil are large, only half a person for 30 acres for the farmer; and reckoning labour at 8s. an acre, it is £. 12. for 30 acres, or $2\frac{1}{2}$ persons; in all three	-	3	1 0
Remain for market	-	5	1 0
Grass for ditto	-	3	1 5

But a fraction to be deducted for farmer and shepherd. The difference therefore as five to three. But, if the barley be consumed in bread, the account will be,

	<i>Persons.</i>	<i>Yrs.</i>	<i>Wks.</i>
Brought	-	-	5 1 0
Barley	-	$4\frac{1}{2}$	1 10 0
Together		9 $\frac{1}{2}$	1 0
Grass	-	3	1 5

Arable superiour therefore as nearly three to one.

Upon the whole of these comparisons it is sufficiently clear, that the arable land is, and in every case may be (by eating barley and oats) far superiour to grass land in the article of feeding, not only the people at large, but also in sending a surplus to market.

I cannot, however, let these papers go from my hands without calling on the Board to read them with candour: I presume to offer them but as rough sketches that may approximate to truth, but cannot reach exactness: they may afford hints useful to future inquiries, and the subject is interesting enough to answer well a very careful examination.

One observation that goes generally to all is too material to be omitted: the production of meat in England is of small importance compared with that of corn, because the poor do not live on the former; meat is the consumption, generally speaking, of those who are in very easy circumstances, compared with the great consumers of corn; nor would the times be much complained of, whatever the price of meat might be, provided corn were at a reasonable price. This is a circumstance

which should be considered as decisive of the inquiry ; and sufficient to prove, that the great interests of the public demand every possible encouragement to tillage, so given, as shall preserve corn at a fair price, neither too high for the poor, nor so low as to discourage the cultivation.

CHAPTER III.

What ought to be the proportion between the Grass and Arable Land of a Farm ?

THIS is another point which I consider rather as a previous inquiry, than a part of the main question to be considered.

Errors in this case are extremely common among landlords, and not less so with farmers ; in general, however, they both look to their own interest : the first to keep much in grass,* and the latter to plough all they can ; with short leases, and bad covenants, we are not to be surprized at either.

Clay.

On this soil, when tenacious and not easily drained, a larger portion should be kept in grass than perhaps on any other ; and for this reason,—green winter food is

* “ One acre of moderate corn,” says Adam Smith, “ yields a greater neat profit than an acre of the best pasture.” *Wealth of Nations*.

“ Experience,” says Mr. Davis of Longleat, “ sufficiently evinces the extreme difficulty of persuading *tenants* to believe that they get more, generally speaking, by feeding their lands than by ploughing them ; yet it requires very few arguments to convince a *landlord*, that in cold wet lands, especially, the less ploughed land you have, the less you put it in a *tenant's* power to ruin your estate. That a tenant of £60. *per annum* in a dairy farm will get money, while a corn farm will starve its occupier (though, perhaps, the former gives 15s. an acre for his land, and the other but 10s.) is self-evident.”

“ Perhaps,” says Mr. Billingsley, “ there cannot be a stronger proof of the inferiority of the plough, with respect to profit, than the superiour punctuality of the dairy farmer in the payment of his rent. I never met with the steward of a manor devoted partly to corn and partly to dairy farms who controverted this,” *Bath Mem.* Vol. III. p. 78. 83 ; written in 1784.

not to be gained at all, or, if gained, not without great difficulty and expense; consequently, the team, and whatever cattle may be kept for consuming straw and making dung, must depend in a larger measure on meadow hay, than upon soils which admit turnip, cabbage, &c. Clover will do on clay, but it is more hazardous and liable to failure; in which case, without a certain resource in the hay of natural grass, the farmer would often find great inconveniencies. I have examined many farms with this object in view, and found that when half the land has been grass, they have been more profitably conducted than with a less proportion; but on no account with less than one-third.

Loam.

One-third or one-fourth in grass is a proportion found suitable to various loams; the more they tend to wetness the larger the portion. It is not however essential on these soils, not only because clover and other artificial grasses are less apt to fail; but likewise by reason of their admitting profitably the alternate husbandry of grass and arable; of which more hereafter.

Sand.

Some rich sands are of so happy a texture, that they do very well in permanent grass, and without *burning* in slight droughts; but, in general, it may be observed, that sand in its several varieties is, of all other soils, that which pays best in tillage: it is easily worked; expenses are light; it manures itself by agreeing well with sheep; and, as the result of the whole, farmers are usually rich upon it. In respect of the proportion, it is best managed, perhaps, when the whole is under the plough; for by means of cultivated grasses, of proper sorts, all the stock of the farm may be profitably supported, and the land rested sufficiently for ensuring a perpetual production of corn. But, contrary to this maxim, and most unprofitably, large tracts are commonly tied up from the plough, by covenants of leases, under the name of sheep-walk, heath, &c. which would, by alternate tillage and rest, produce more corn, and keep more sheep, than in the present state: this is particularly the case in Norfolk, Suffolk, Nottinghamshire, &c.

Chalk,

Including lime-stone soils. Nearly the same observation is to be made on this class: they are more productive under the plough than in grass. But landlords

tie up their tenants from ploughing downs in Sussex, Hampshire, Dorsetshire, and Wiltshire; but in Gloucestershire, the East Riding of Yorkshire, and Lincolnshire, they have on the whole been less tenacious: still, however, large tracts remain, which would be ploughed were tillage permitted. Rules may be carried too far, and this among the rest; Dorsetshire has its *ewe leases*, which in many cases ought not to be touched; and fine sweet downs, which by very attentive management have been brought to a considerable degree of fertility, are so useful to sheep in winter, that exceptions must occur. Another motive for ploughing, is, the peculiar advantages derived on this soil from sainfoin, one of the most useful grasses that we owe to the bounty of providence; but attainable only by tillage.

Prat,

Including the immense regions of the moors which spread widely through all the northern counties, and even in the most southern, as Devonshire, and Somersetshire, Cambridgeshire, and Wales; also, the sedgy bottoms, mentioned by the Board, are found every where. They admit and call for a much greater improvement than any other soil, comprehending the larger part of the waste lands of the kingdom. These soils are very rarely brought into the state they are capable of, without tillage, and, consequently, to prohibit it, is to pass a decree of perpetual sterility. The obstacle, however, most common on moors, is the rights of commonage, which do not come within the scope of the present inquiries. When improved, they are commonly much more adapted to grass than to tillage, not, however, without numerous exceptions, as we see by the general practice in the fens of Cambridgeshire, and Lincolnshire. The alternate husbandry does well upon them; it is easy, however, to be too busy with the plough, for when good grass is gained, it is the wiser way to continue it.

This subject, of the proportion between grass and arable, requires a word or two, viewed in another light, besides the relation to soil.

This is the prevalent application of the land.

In the midland counties, where grazing very widely extends, it is common to see entire farms of grass land, and the tenant prohibited from breaking up an acre; in such cases there is a motive for ploughing not immediately connected with soil. To till a part would be right, whatever the soil may be: straw, in such a country, is not to be bought, and the convenience and profit of having some, is no incon-

siderable object; it would be carefully used as litter, and the manure arising would improve a portion of the land. Some cabbages, or Swedish turnip, or common turnip, might be raised, (which, to a certain extent, and for certain objects on such farms, would be highly valuable to the grazier,) so as to outweigh large expenses in procuring them on soils not quite adapted to their culture. There is not a question but a farmer in such cases could afford to pay more rent for liberty to plough a portion of his land, than under the present covenants. This would extend to a fourth of the farm in soils rather unfavourable to the plough; and to a larger proportion in others. But even three or four small fields, though no more than one-fifth, one-sixth, or one-tenth, would be highly advantageous to himself and the public, and not at all injurious to the landlord.

To dairy farms, when entirely in grass, as many are in Wiltshire, Gloucestershire, and other counties, this remark is yet more applicable, as the produce of tillage, straw, cabbage, &c. is yet more necessary than in a mere fattening system. In this case, and indeed in most others, the quantity might be partly regulated by the team: a dairy farmer who keeps four horses to draw his butter or cheese to fairs, &c. ought, without question, to have tillage enough to employ those horses: and it is no difficult matter to ascertain that quantity. If the various works be examined carefully, it will be found, that a horse to 20 acres of tillage is a fair proportion, which will leave time for carting hay in summer, and the products of the farm in winter. I am not speaking here of tillage farms on sands, &c. or with rotations of crops in which the soil rests for several years; on such the proportion varies; but merely on grass farms where some horses must be kept, and are at present unemployed a large part of the year.

Meadow farms, properly so called, are never to my knowledge, met with but in the vicinity of great cities, where the demand for hay is great and uniform; horses on such are kept only for the purpose of carrying hay to market; bringing dung back; carting the hay to the stack, and the manure to the fields. Straw is wanting for litter and for thatch; but it is questionable whether it be profitable to plough for this object only in any case; a scattering of tillage is in some places found, but not by any certain rule; the necessity is small, and straw usually to be purchased. Such districts, being highly improved, demand very little attention.

CHAPTER IV.

Circumstances by which a Landlord may suffer from ploughing Grass Land.

UNDER this head two points are chiefly to be considered.—1. The exhausting of the soil.—2. Buildings.

Let us suppose, that by the covenant which permits tillage, the tenant is to pay, what appears to be a fair addition of rent for the privilege of ploughing; still the landlord may in the end be a considerable sufferer, if due attention be not paid to the above-mentioned circumstances.

Every one knows, that the breaking up of old grass land is attended, commonly, with great products of corn. Upon inclosing commons by acts of parliament, I know cases, in which a Last * an acre of oats has been gained, twice in succession, and great crops of every thing sown for some years. A large field of grazing land was ploughed near Lewes in Sussex, and sown with wheat for eight or nine successive years, producing every year from seven to five quarters an acre: the proprietor declared he would sow it as long as it would yield four quarters an acre; and when the crop fell a little short, he thought it time to give a fallow. Instances of the vast productiveness of old grass, when ploughed, are every where to be found: † this fertility is the parent of husbandry mischievous to the landlord, though immensely beneficial to the tenant: he presently gains the fee simple of the land, but at the end of his operations it is deteriorated to the amount perhaps of half the rent. In the case of old grass, the landlord perhaps may not make use of his hidden treasure, but still it is in his possession; and he can apply it when he pleases. Many words are not necessary to shew, that by tillage, under bad covenants, he may be a considerable loser.

* Eighty-four bushels.

† Mr. Marshall mentions six crops of wheat running, on breaking up old grass in the vale of Gloucester, the last crop nearly as good as the first. Vol. I. p. 68.

In the Lincoln report are many similar cases; and every one knows the great rents paid for cultivating wood on the richest old pastures; with such soils I am not solicitous to be particular; they admit of any system with profit, except that of being exhausted by repeated crops for several years.

With regard to buildings the case is not equally obvious; yet it ought not to escape his attention. A tenant may come with flattering proposals to break up a large tract of grass; and, for the sake of the profit he has in view, will say nothing of new erections, which he knows may prove an obstacle to his views. But when the farm comes to be let again, and no such immediate profit is in prospect, a new tenant will no sooner examine the farm than he will make new barns, stables, &c. &c. one of his first demands, not easily answered or set aside;—the expense heavy;—and the repairs an object. I by no means state this as a motive for refusing permission to break up land, but merely to put landlords upon their guard, that they may in no case deceive themselves, but foresee every contingency.

But here an object presents itself which deserves attention; and this is, thrashing mills.

These machines have hitherto been erected without any design of rendering them the means of saving buildings: but perhaps their chief object, properly considered, would be this effect. Stack stables to receive the corn, and a very slight shed to cover the machine, with a repository for the grain, and another for the chaff, are all that are necessary; the expense of the whole not amounting to the half of that of a moderate barn. This is a point of considerable importance in lessening the landlord's expenses. I have heard of objections to thrashing mills by reason of their depriving labourers of their employment; were this a proper opportunity, I conceive all those objections might be entirely done away; but the fact is, they do not apply to the case of bringing new lands into tillage, which ought to be done with as little labour as possible; in order that the more of the produce may find its way where only it can influence *price*, that is to market.

Another circumstance, but of less importance than the preceding, in which landlords may be said to suffer, is the additional trouble of overseeing and keeping tenants to their covenants upon arable land on comparison with grass: there is this greater trouble undoubtedly, but it is for their stewards; and I can scarcely suppose that any man on this account would forego his own advantage: the object is worth mentioning, and nothing more.

There are circumstances in cropping in which inattention is very mischievous, but those will be adverted to hereafter.

CHAPTER V.

Circumstances wherein a Landlord may be benefited by ploughing.

THESE are found in almost every sort of soil. Rent is not the present inquiry, though a very proper object when a considerable benefit is to accrue to the tenant.

Clay.

Upon clay soils grass is often met with so hide-bound, poached, and poor, from having been badly laid down, or ill management, as to produce scarcely any thing but aquatic coarse grasses and weeds, refused by every sort of stock, unless in a starving state. Such land remains unploughed, without the proprietor receiving the benefit, which, in a silent and unperceived manner, he is almost sure to receive, from the mere effect of age on pastures, when they have been well laid down, and tolerably managed: such, in a progress of years, are on the improving hand, by that gradual increase in the depth of vegetable mould which accrues from pasturage, though slowly.* If grass on this soil when tenacious be thus on the mending

* The origin of the black vegetable mould has been attributed by naturalists to various causes, but, with most probability, to that putrefaction of vegetables which takes place most in grass land. It has been calculated at half an inch in 100 years, † a proportion which Wallerius questions. ‡ An instance of Mr. Forster's against it is strongly for it. "In Russia, on this side the river Volga, are high and extensive plains, which have been uncultivated ever since the deluge; for we know from history that the Scythians, Sarmatians, Huns, Chazans, and Mogols, were successively masters of these vast countries, and altogether nomadic nations, who lived without agriculture: the country has been without wood since time immemorial, nor could there ever spring up any wood whatsoever, since its rambling possessors, every spring, set fire to the old dry grass in order to make room for the new grass, which in the latter end of May I found come up very near to my waist; and these vast desert plains I found every where covered with at least two feet mould, and in some places four feet." § In this case here is an immense depth of vegetable mould from grass *alone*, and agrees with the observations which may be made by any attentive aged person, or from the information of such, that the rich surface soil of grass land increases with age. A sure proof of its high state of amelioration.

† *Ol. Rudbeck, Atlantica*, Lib. 1. cap. 6. Forster.

‡ *Mineralogy*, sect. viii.

§ Note on *Kalm's Travels*, Vol. I. p. 152.

hand, it is imprudent to plough it, because the soil is unfavourable to tillage; but when the herbage is of a very bad quality, a course of tillage gets rid of it; proper seeds may be sown, and then the field may be in the right progression, and the farm improving to the landlord's profit.

Loam.

The same observation is applicable to this soil in its humid varieties. Great tracts of poor upland pastures, upon land that would yield turnips very well with only common hollow draining, have the reputation of wet clays, merely from neglect; but are so stocked with bad herbage, that tillage is necessary in order to bring them to profit. Also, we often meet with gravelly loams, (especially if affected by a vitriolic impregnation, of which many instances occur in Hertfordshire,) that are hide-bound, and miserably poor, where tillage is the only preparatory step for bringing them ever to bear good grass.

Sand.

But here is a much greater field for the landlord reaping considerable profit, while the tenant's interest is capially promoted.

The question of ploughing heaths and sheep walks has been often agitated; and several writers have declared against it. But the good sense of the world has gradually, though but slowly, prevailed; and great improvements have been the consequence.

West Norfolk has been all converted from sheep-walk and warren, to fine corn fields, within about 70 years. For the larger part of that period a notion prevailed, however, very generally, and not yet eradicated, that every farm should have a portion of the old walk left for the same use: this idea has been, and is strenuously contended for: it is amusing enough, to observe their practice gradually getting the better of their theory, and these deserts visibly contracting every eight or ten years; upon some farms totally extirpated, and lessening upon all. The same observations are equally applicable to the sands of Suffolk; upon which great sheep walks were found 20 or 30 years ago, now in a regular course of tillage: this is obvious by Woodbridge, and Sutton, to the *Sandlings*.

In both these instances, it is only necessary to compare the assertions made twenty years ago, upon the necessity of preserving these walks, with the present extent of them, and the contradiction will be manifest. Still, however, they are far too

extensive : nearly the whole country from Thetford to Swaffham is thus wretchedly occupied ; and upon most farms are found tracts in the same neglected state. The cause is in landlords who are contented with a rent of 2*s.*, 2*s.* 6*d.*, or 3*s.* 6*d.* an acre, instead of 8*s.* or 10*s.* : at such low rents the tenant who reckons by the capital he employs, makes a great profit by them, and thus the indolence of one party, and a mischievous calculation by the other, perpetuate the evil.

Nottinghamshire also, in this respect, has done much ; but she has by no means done all.

Chalk.

This soil offers a still larger field for improvement : the downs of Wiltshire, Sussex, Hampshire, and Dorsetshire, and the wolds of the East Riding of Yorkshire, have every where begun to give way to the plough ; but not in the degree they ought to do : it would be very much for the landlord's benefit to insist on their being ploughed ; that is, to double their rent, and let the tenant pay himself by tillage, under due covenants. Downs near Salisbury are let at 2*s.* 6*d.* an acre, for which the tenants would give 8*s.* and 10*s.* an acre, under the plough ; * in Hampshire, † many landlords think that ploughing has done harm, yet they receive, mischievous as the course of crops has been, double the former rent : the fact is, that by means of turnips, and grasses, including sainfoin, more sheep may be kept, than when the land was in its down state, and, with this capital security, the landlord cannot suffer. But, with paring and burning for three successive crops of corn, sheep may disappear ; the soil become exhausted, and ploughing downs condemned, in the gross, as the worst of husbandry. Few landlords are in possession of downs who have not a power of greatly promoting the public good, and at the same time, without any danger of exhausting the soil, under due covenants, of advancing their rents.

Peat.

The soils that come under this denomination may be improved, without tillage : Derbyshire contains many instances within the memory of persons now living,

* Mr. Marshall, in his *York Economy*, gives an instance of a farmer's flock on the wolds, scattered over 15 or 20 miles in winter kept at the expense of £ 20. a week, because his landlord will not permit any walk to be broken up, even to raise turnips. Vol. II. p. 250.

† *Disports*, p. 68.

effected by an immense manuring of lime; but such cases are exceptions. Generally speaking, these soils are much more profitably improved by means of tillage; if in level countries, with a view either to grass or corn, according to circumstances; but in high moors and mountains, grass should pretty generally be the object; and tillage for potatoes, cabbage, turnip, and rape, be no more than a preparation to lay the land down to pasture or meadow. That the landlord is essentially benefited by such tillage, is too obvious to dwell on.

Those who have had the opportunity of viewing much of the kingdom must know well, that lands, under these various descriptions, which would admit tillage to the great emolument of the proprietors, constitute a very considerable portion of the kingdom; and that when permission is wisely given to plough them, under judicious covenants, the public interests will be most essentially promoted; the tenantry will be enriched, and landlords find their rental considerably advanced, without any evils resulting from such a conduct.

CHAPTER VI.

Of the Method of breaking up Grass Lands.

THIS subject the Board requires to be considered in detail: not, it is presumed, as an instruction for drawing the covenants of leases; (as in most cases it would be more proper to leave some of the particulars, such as depth of ploughing to tenants;) but that landlords who may be inclined to break up grass in their own occupation, may easily have recourse to the best advice in the power of your respectable Body to procure.

The subject divides itself into the following considerations:

1. Previous draining.
2. Paring and burning.
3. Depth of ploughing.
4. Ridges.
5. Course of crops.

SECTION I.—*Previous Draining.*

The state in which land should be, for draining, admits but of one question,—the right moment for applying the Essex method of hollow draining; in which there is a diversity of opinion, it being a point on which something may be plausibly advanced on both sides. As to all other cases, such as the greater exertions of large open drains; the brick soughs of Mr. Elkington, &c. they should be unexceptionably performed previously to all tillage: an assertion which many practical reasons support: they imply a degree of wetness which would be ruinous in tillage; and as that wetness commonly proceeds from powerful springs, much carting and trampling could not be permitted after ploughing, even in summer, without essential mischief. Another object in extensive works, especially on moors, upon the slopes of hills, and mountains, is the union of draining and irrigation: the general mouth of many drains may, in numerous cases, be made the constant supply of a system of watering below it; and, till this be ascertained, the improver is uncertain what land it will be advisable to break up, and what otherwise to improve by water; as it may be admitted as a maxim, that water, where it can be had, should be tried with mere levelling, before any other methods be attempted. Upon the high moors to the south of Pately-bridge in Yorkshire, there are some remarkable instances of small abandoned mill courses having overflowed the ling moor below them, and thereby destroyed the ling, and established a large family of grasses, converting black into what they call *white land*, and though, like all the rest of the moors, in a state of utter neglect, this accidental circumstance excepted, yet would let, with a wall fence around it, at 10s. an acre, instead of 6d. or 9d. When the effect is so remarkable, it is a proof that not a drop of water should be lost, but that of the drains be converted from an enemy into a friend.

With regard to the question of the season for making Essex drains, it is the practice of many farmers to choose the year of fallow for the work; because it is better done they think in summer, than in winter; and while in fallow, than when under clover; though that clover be fed: if this be really the fact, it probably depends, not only on the land being sufficiently dry to admit carting the straw and bushes, but also, on the effect which the sun and air have, by drying the earth of the sides of the cuts, of avoiding that plastering which the action of the spade forms in digging them in wet weather; by which they are apt afterwards to bleed

through the pores less freely ; and there may be something in this : other farmers do the work in winter ; partly, because they have a better opportunity, on flat fields, of seeing how the drains *draw*, as it is termed ; and partly, because labourers are at that season easier to be had : but poaching the surface is an objection upon arable land. It seems on every account to be desirable that such soils, as well as others, and whether the work be done in winter or summer, should be drained while in grass : poaching is avoided, and, if the surface be tough, it gives an opportunity of making sod drains, which are cheaper than filling them either with bushes or straw.

On the whole, it is presumed to be better, in every case, to drain grass lands before breaking them up, whatever the soil may be. To enter into any detail of the methods of draining would be out of place, whatever use might attend it.

SECTION II.—*Paring and burning.*

Before we come to the distinctions of soil, it will be proper to offer some general observations on the diametrically opposite systems embraced by such numbers of persons on the general question, whether this practice be excellent, or worthless ; as two parties have decisively pronounced it.

By one set it is pronounced, contrary to every principle—that it is a wasteful, extravagant operation, which dissipates what should be retained ; annihilates oils and muelage ; calcines salts ; and reduces fertile organic matter into ashes of very weak efficacy ; that the vegetable particles which are brought into play at once for the production of a single crop, by less desperate management, might be husbanded to the support of many. On the contrary, the advocates for this operation assert, that these objections are all founded on vain reasoning, and philosophical theory ; that practice the most decided, and experience the most extended, pronounce it to be an admirable system ; and that the mischiefs, often quoted as flowing from it, are to be attributed merely to the abuse of the method, and by no means necessarily connected with it.

I must without the least hesitation declare that the latter of these opinions is that to which I subscribe. To trust to reasoning in matters of agriculture is a most dangerous reliance : I shall leave others to detail their philosophical speculations ; and rest what I have to offer solely on the practice, various and extensive, of numerous agriculturists, and on the common husbandry of many spacious districts.

These agree in declaring, (and it is most particularly to be had in remembrance, for the enemies of the practice admit it,) that by paring and burning you may command two or three good corn crops in succession: the fact cannot be denied; for whether you examine the peat of the Cambridgeshire fens, or the shallow chalk soils of the downs and wolds of Hampshire, Gloucestershire, or the East Riding of Yorkshire, it is known, that bad farmers do act thus absurdly; they get indeed great crops, but they too often take them in succession, to the injury of the soil, though not to its ruin; unless that can be esteemed the ruin of land which enables the tenant to pay a double rent for it. Such farmers have been in the habit of burning for wheat, and then taking two crops of spring-corn; all good: now it might be asked, how is it possible that that husbandry can produce all the evils detailed above, which enables a soil, naturally poor and weak, to give two or three good crops of corn? Their argument evidently proves too much: the effect shews, that there is a powerful cause or agent in burning, which they do not understand; which escapes from the retort of the chemist, and from the *rationalis* of the theorist: that operation or manure which will give a good crop of wheat, will give a good crop of turnips or cabbage; and he who having made this commencement for the food of sheep on the land, and knows not how to go on, preserving the advantage he has gained, is a novice in the art of husbandry. The farmers that are railed at know it as well as their philosophical instructors; but avarice, united with the baneful effect of short or no leases, makes them practice against their judgments.

Paring and burning will on all sorts of land give turnip or cabbage; these fed on the land by sheep will secure barley, or oats and seeds; the seeds, fed with sheep, whether for a short or a longer duration, will secure another crop of corn adapted to the soil; and in this stage of the progress the soil will have gained much more than it has lost. To instance cases which I have seen, and quote authorities for these assertions, would be tiresome. I can assure the Board, that instances might be produced from more than half the counties of the kingdom.

It has often been contended, that burning lessens the soil; if this happen any where, it must be in peat; yet in the fens of Cambridgeshire this husbandry has been repeated once in eight years for a century and a half; and the proofs of a loss of depth are extremely vague in every instance I have met with, and hardly to be distinguished from that undoubted subsidence which takes place in drained bogs of every description. In all other soils the assertion may be safely and positively

denied: I have calcined pared turf, not calcareous, after careful separation and weighing, and in a heat far exceeding what is ever given in denshiring heaps; and reweighing, found the loss too minute to attribute to any thing but loss of water intimately combined, but driven off by heat; and re-exposing the earth to the atmosphere free from rain, found an increase rather than a diminution of weight: the vegetable particles only are reduced to ashes; these, in any method of putrefaction, would dissolve; and, combining with water, be exhaled by heat, or absorbed by the vessels of plants: in ashes these are in a more fixed state relatively to the influences of the atmosphere; and that plants feed on them, the great crops, which succeed, offer abundant proof.

There are men who are timid in acknowledging truth, yet admit the practice to be good in poor soils, and in peat, and sedgy bottoms, but fear it on better land. Experiment is against them; for in Yorkshire, land of 20s. and 30s. an acre, has been thus broken up with great success; but in what manner do they reason? rich soils are full of vegetable fibres: then there will be the more ashes: these are in proportion to the organic matter; peat, which these men admit to be burnt, is the richest soil in the world; and therefore burning the most universally practised on it; the soil is not reduced, and if it was rich before burning, assuredly it will be rich after it.

In addition to these circumstances is the capital one of destroying insects, grubs, and weeds; these are apt to abound most in the richer soils; no reason for abstaining from this husbandry on such.

I venture therefore to conclude, that paring and burning, with a proper course of crops, is safe on any soil; * and essentially necessary on some, as I shall presently shew.

Clay.

The gentlemen, who have objected to paring and burning, have not given many reasons peculiarly appropriate to this soil; the only one that merits the least attention is, the assertion that it converts what is properly soil into pieces of unfertile brick: the fact is not so; for every one who has burnt clay for *manure* knows, that though there be many lumps of the substance which they allude to, yet that

* Very rich ones will do exceedingly well, in many cases, without it; this distinction therefore should be made. There is, in some cases, no necessity for it; there is in others.

the mass of the heap consists of ashes properly so called; but when the tenacity of this soil be considered (which is one of its greatest evils) it will be found that bricks are an excellent addition to the soil, to loosen and open its stubborn adhesion.

Heaps of clay ashes, amounting to many hundreds of loads, have been burnt and applied to great profit on this soil. By paring and burning you have therefore on it the common manure found in vegetable ashes; and you have in addition a substance which acts mechanically. Hitt, who wrote from practice, and abounds with many just observations, remarks—"I recommend burning of the surface as the cheapest manure and most effectual of any; for it not only adds salts to the soil, (which the burning of grass-roots produces,) but it opens part of the stratum of clay next the soil so much, that the roots of vegetables can afterwards feed therein; for when the turf of a piece of land has been burnt in heaps at four or five yards apart, though all the ashes be taken away with some of the earth and spread over the other parts of the land, yet neither corn nor turnips will grow so vigorously there, as on those places that were only opened by heat."

Loam.

This is the soil, especially when good, upon which the practice has been most condemned; but here we have some experiments to recur to, which, in my estimation, set the matter in so clear a light, that nothing more is necessary than to recite them very shortly. Mr. Wilkes, of Measham in Derbyshire, has for many years been in the practice of ploughing old rough pastures (the soil a stiffish loam) eight or nine inches deep, and burning the whole furrow in heaps of thirty or forty bushels each; the fires lighted by a few coals, and coal slack; the effect very great; and the improvement immense, and durable. Mr. Wilkes is of opinion, from the experience of many years, that even this burning, which is twenty times the depth of common paring, does not waste the soil in the least; that its effect is to break the texture of stiff soils, and expel a great quantity of water; that by exposition to the atmosphere, the land re-absorbs its water; and, by the great immediate fertility, fills itself presently with more vegetable particles than it had before. Thirty years ago his father burned at Overseal, exactly in the manner described, a field of ten acres, which was not then, and has not since, been treated with any more favour than the fields adjoining; yet it has ever since retained a superiority.

The writer of this memoir, on the farm which he manages, in 1790, hollow.

drained an old grass field of $4\frac{1}{2}$ acres of cold wet poor loam on a clay marle bottom; the rent 9s. an acre, and not worth more in its then state perhaps, than 7s. In 1791 it was ploughed four inches deep, and the whole furrow, of four acres burnt, which was the whole depth of the soil, or surface, of different colour from the second stratum between that surface, and the clay marle: having no coal slack, and wood being dear, he made but four heaps in the field; the consequence was, the heat and degree of calcination were far beyond what is ever practised in common; and many persons who knew and approved of paring and burning in the common way, pronounced the field completely ruined. The ashes were spread and ploughed in with a shallow furrow, and turnip-seed sown, and very slightly bush-harrowed. The crop was very fine; worth, to sell for feeding on the land, at least 50s. an acre. * After being fed with sheep the land was ploughed thrice, and sown with oats and grasses: the oats produced above seven quarters an acre; and the grass has ever since been much better worth 20s. an acre, than it was worth 5s. before: the oats on the half acre were not thrashed separately, but judged by those who viewed them to be much inferior to the rest. About half the field has been since dressed with earth and road sulliage; and once dunged slightly. It is remarkable, that in three years, *crested dog's-tail*, an excellent grass common in the country, began to appear, and has been increasing ever since. There is at present no perceptible difference between the part burnt, and the other not burnt; if any thing, the burnt is best. These two experiments prove, if any thing can, that paring and burning does not lessen the soil in its most excessive application: and that it works a very great improvement on loams.

Sand.

Hit, a practitioner of this husbandry, says, that it improves sandy soils as much as any other; and I have seen in Suffolk, and in Cambridgeshire, fields improved by it; though under a course of crops by no means advantageous. There is not the least reason from analogy to doubt the effect on this, or indeed on any soil.

Cbalk.

Here we have a much more ample field of experience; for it has been, and is the common method of breaking up downs in every part of England. On the

* The crop on the burnt part double to that of the half acre.

Cotteswold Hills in Gloucestershire it is the common husbandry, and often repeated; the sheep-walks and warrens on the wolds of the East Riding of Yorkshire, and of Lincolnshire, have thus been brought, most profitably, into culture; though not with the attention in cropping that ought to have been given. In Hampshire, and Wiltshire, the same husbandry prevails; in these counties it is said there are lands that have been pronounced ruined by the husbandry; the cropping was bad; but still the rent had been doubled by the practice. • In Kent, Mr. Boys shall speak for himself. In a letter to the editor of the *Annals of Agriculture*, he says, "If any persons, who condemn paring and burning, should come into Kent this summer (1795) I can shew them several scores of acres of wheat, barley, oats, and sainfoin, now growing on land which has several times undergone that operation: the crops of sufficient value to buy the land at more than forty years purchase, at a fairly estimated rent before the improvement."

Peat.

This article may be dispatched in a very few words. Whatever variety of sentiments there may be on this method for other soils, here there can be none. The universal practice from the flat fens of Cambridgeshire to the swelling bogs of Ireland; on the mountainous moors of the north of England; and on the rough sedgy bottoms in almost every part of the kingdom, when fresh lands are broken up by men of real practice and observation, is to begin by paring and burning. Registered experiments of doing it by fallowing are to be met with in various works: the Board's Reports of the North Riding of Yorkshire, and of Somersetshire, detail some; others are to be found in Mr. Young's *Tours*; and the result is, either loss, or a profit so very inferior, that the question ought to be considered as settled and done with; let it sleep for ever; except for the wrongheaded individuals who will, upon every question, arise, in every age, to contradict the common sense of mankind. I could detail cases without end, but really think it would be a loss of time for the Board to read them.

• In the West Riding, Col. St. Ledger remarks, that if burning wasted the soil, his lime-stone lands, only four inches deep, would have been gone long ago; as they had been pared and burnt for ages. *Eastern Tour.*

SECTION III.—*Depth of ploughing.*

This point demands some attention:

It should be considered, first with relation to breaking up by paring and burning ; and secondly by mere ploughing.

It is a nearly general notion in every part of the kingdom, that the first ploughing, after this operation, should be shallow. We cannot admit that the idea being far spread, is therefore just ; for the same notion prevails every where with relation to dung and the sheep fold ; in which case there is reason to believe it erroneous. Manures that purrify, and consequently become volatile, cannot be *buried*, to use the farming term ; plough as deep as you please, they all rise, sooner or later, into the atmosphere ; but with fossil bodies, and, probably, with the ashes of paring and burning, the case may in a good measure be different : and the great success of the common management gives reason to justify the principles on which it proceeds. It may therefore be deemed a safe maxim not to plough after this operation, for the first time, more than three, or at most not more than four, inches.

With relation to breaking up grass lands, by ploughing, for various crops, where it is not intended to burn, it has been performed many times on all the sorts of land mentioned by the Board ; and largely on the farm, under my management, on gravelly loams, and on clayey and sandy loams ; and I never remarked any striking difference, either in the practice, or the effect. But in counties where they usually plough deep, that is six, seven, or eight inches, I have observed (and it has been my own practice) that they plough up old grass shallower ; that is, not above four inches deep, or at most five. A crop is every where put in on this first ploughing ; except only in the case of summer fallowing peat and other moors : by not ploughing deep, the atmosphere has a more direct influence in assisting the putrefaction of the sod ; covered as it is with a crop, perhaps, a smothering one.

Two circumstances here merit notice ; which are, the use of the skim coulter plough ; and sowing on a stale furrow.

Mr. Duckett's skim coulter plough I consider as one of the best implements ever invented. It is most effectual, and applicable to a great variety of purposes ; but to none more than breaking up old grass land. Every one knows, that when this is done with a common plough, there is between every furrow a seam of grass and weeds, that vegetate through the summer and injure the crop ; but this is entirely

prevented by the skim coulter ; which is applicable to every sort of soil that does not contain on the surface impediments of roots or stones.

The other point, that of sowing on a stale furrow, is a very good practice in cases of breaking old lay, when done on soils that are not ticklish for getting on : wet clays and loams, if supposed not to be well drained, are often obliged to be sown too late in the spring, if ploughed in autumn ; in which case it is safer to plough and dibble at once ; but on other soils dry enough, as dry loam, sands, and chalk, it is better to plough in autumn and plant early in the spring : the frosts and successive variations of weather sweeten the freshly turned up soil, and crumble the surface enough to give a little mould ; and not too much to impede the dibbles.

SECTION IV.—*Ridges.*

The Board has not made any inquiry upon this subject ; which appears to me to be of too much consequence to be entirely overlooked.

In a considerable part of this kingdom, perhaps the half of it, the land on all moist or stiff soils, and absurdly on some others, has been for ages ploughed up into high and broad arched ridges. In the midland rich counties, where so much open field arable has been laid down, the fields were sown to grass on these ridges : some individuals, however, (chiefly Gentlemen) have varied from this practice, and, as well for continuing in arable, as for laying to grass, have ploughed down these ridges. What in this case is the wise conduct ?

All the writers I have met with who have described Flanders, represent it as the best cultivated, and most productive country in Europe ; and they mention the land being all thrown up in these ridges ; though broader than such as are common in England. Was the practice universal in Europe ? It should appear to have some good reason for its origin : one, extremely obvious, is that of draining ; for no draining can in the nature of things be equal to a Flemish ridge ; which, by accounts printed, is thus formed



the grains in the furrows dug, and kept clean shovelled. Our ridges are not equally perfect, because they want the drains ; and, by wretched management, are suffered sometimes to be a foot deep in water ; they are also raised too high ; but an Essex drain dug in every furrow would have the Flemish effect. The question, therefore,

is, whether ridges should be thus improved, or absolutely ploughed down in those cases wherein a landlord permits ridged grass land to be broken up?

I must confess I find no difficulty in deciding for the preservation of the ridges. A complete drainage, and a permanent one, is alone a circumstance worth many others: but the evils of burying land, long exposed to the atmosphere, and which has been the receptacle of dung for centuries, and of bringing to the surface other land that has been long buried, and become sterile; or avoiding these evils by very expensive or very tedious operations, are sufficient motives to induce an acquiescence in the present form. If altered, it is with intention to have much flatter ridges, or perhaps none at all; then a very expensive and most complete drainage will be necessary; and at last it will be a very doobiful question, whether it will ever be possible to lay the land so dry, as the single addition of a hollow drain in each furrow will effect, while the arched form be preserved. I have no doubt of the comparison, in neat profit. *

The only hesitation I should have in ploughing these ridged lands would be, whether a strip, of four or five feet width of the grass in the furrows, should not be left in its present state; an Essex drain running along the center. Grass is so left in many fields in the proximity of Peterborough. There is no loss in it; for whether mown, or fed after harvest, the produce is adequate; and all the rest of the ridge is equal for corn.

SECTION V.—*Courses of Crops.*

I esteem this to be the most important subject that has been treated of by the modern writers upon husbandry; and that on which they have thrown far more light than upon any other circumstance in agriculture. It is a very singular and remarkable circumstance, that before the reign of his present Majesty, notwithstanding the multitude of books on agriculture, there is not one author who had any tolerable ideas upon this subject, or even annexed to it any importance. They recite courses, good, bad, and execrable, in the same tone; as matters not open to praise or censure; and unconnected with any principles that could throw light on the arrangement of crops. But when once the idea was properly started, its importance presently became obvious; so that thirty years have carried to great perfection the precepts which practice has afforded in this branch of rural economy.

* Walter Blith, one of the best and most practical writers on agriculture, says, in the time of the Commonwealth—"It has long been known that wet, spewy, and clay soils should, in laying down, be thrown into broad high lands for laying sound and firm." *Imp. Impd.* p. 10, 139.

General Principle.

It is now well known, that some crops exhaust land much more than others ; that some, notwithstanding they exhaust, return, by being consumed on the farm, as much as, or more than they drew from the soil in their growth ; that some admit profitable tillage and cleaning, while growing ; and consequently clean, instead of rendering the land foul with weeds ; while others, not admitting such tillage, and being exhausters, if continued in succession, will deteriorate the land and fill it with weeds. Practice tells us, that by a due arrangement of these crops in courses, land of almost any description may be kept perpetually clean and in heart.

When a field is intended to be laid down to grass, it demands greater attention than common in this article of cropping it ; and for a particular reason : all soils will in course of time cover themselves with that assemblage of plants which in common conversation is called grass ; but on some it demands many years to bring such a covering to any value. It is therefore of material consequence, not only to sow grass seeds adapted to the soil, but also so to clean it, that the bad grasses, and other plants indigenous to it, shall be absolutely extirpated ; or at least as much so as possible for management to effect : for, if such plants be left in the land, they will increase and prevail with more rapidity and effect than the seeds chosen by the farmer ; a fact we see every day with all sorts of crops : nor is any district without numerous instances of fields so badly laid down as to remain unproductive through a long series of years ; the evil is well known, and it may be said almost entirely to result from the preceding course of crops.

Clay.

The inquiries of the Board suppose the landlord to give permission to break up grass land, under covenant that it shall in a certain course of years be laid down again to grass ; and then the question is, what should be the prescribed course of crops between such breaking up and laying down ? For the soils under this general head the following course is to be recommended.

With paring and burning, and for four years tillage ;

1. Parc and burn for cole, to be fed with sheep. 3. Wheat.
2. Beans. 4. Fallow and grass.

S 2

For 6 years tillage ;

1. Cole.
2. Beans.
3. Wheat.
4. Beans.
5. Wheat.
6. Fallow and grass.

In some cases cabbages will be a more profitable crop than cole ; in either case they must be fed on the land with sheep ; this is the only difficulty on wet and stiff soils ; it can only be done in autumn, in frosts, or in seasons unusually dry : as the point demands attention, and is liable to errors, the succeeding crop is directed to be beans, a plant which does well on soils of a greater degree of tenacity than any other ; it does well also on a whole furrow, dibbled in ; so that if the cole or cabbages were fed in a rather unfavourable season, and the surface left in too firm a state for white corn, yet it will do well for beans ; as I have found on the farm which I manage, and got good beans and wheat after them following cole and turnips, fed in too wet a season to permit barley or oats to be put in. I suppose the beans (as they ought to be) dibbled one row on every other furrow ; and thoroughly horse and hand-hoed.

On all clay soils it is essential to sow grass-seeds on a summer fallow in August : spring sowing on these lands is much too hazardous and ticklish for such a venture : nor can the land be got, at that season, into sufficient tilth to receive those seeds ; four or five ploughings and good working are necessary to prepare for them.

Without paring and burning. Break up the old grass by one earth, and dibble in,

1. Beans.
2. Oats.
3. Clover.
4. Beans.
5. Wheat.
6. Fallow and grass.

If as much wheat as possible be in contemplation,

- | | |
|----------------------|----------------------|
| 1. Beans. | |
| 2. Wheat. | |
| 3. Beans. | |
| 4. Wheat. - - - - - | 5. Beans. |
| 5. Fallow and grass. | 6. Wheat. |
| | 7. Fallow and grass. |

These several rotations for breaking up clay soils will all be found very profitable. Old turf is the best matrix for beans, a crop that rarely fails upon it; for wheat also it is highly beneficial, when broken by a little tillage. A circumstance to attend to is the red or wire-worm, and the grub, which are apt to abound in all old grass land. One caution that has been found very useful is, to keep grass land, previously to tillage, close fed and bare after the month of July; by which means the fly does not find the shelter for its eggs which tempts it when the grass is left longer: beans are not attacked; should the following wheat suffer materially, so as to make it necessary to put in another crop, the land should not be ploughed again, but a second crop of beans dibbled in the spring; and if discovered too late for that, then to plough and drill in pease, of a sort that ripen the earliest; (white pease excepted which will not do on clay :) afterwards wheat will be safe. But where the grub is suspected, paring and burning should always be had recourse to. Of manuring I shall speak hereafter.

Loam.

The courses of crops applicable to this soil are very numerous.

In regard to paring and burning, one general observation will be sufficient for all exceptions on that account; which is, that turnips are always to be the crop on this operation; then barley, clover, and wheat: and another rule never to be departed from, is, that all turnips are to be wholly fed on the land by sheep; which is a point I know, from some experience on several loams, to be essential. There is a vast difference, in the system of breaking up grass for future laying down, between feeding these roots where they grow, and eating them off; and using the dung arising on the consumption in the too common application of spreading it for wheat.

- | | | |
|-----------|---|-----------------------|
| Six years | { | 1. Turnips. |
| | | 2. Barley. |
| | | 3. Clover. |
| | | 4. Wheat. |
| | | 5. Turnips. |
| Ten years | { | 6. Barley and grass. |
| | | 7. Clover. |
| | | 8. Wheat. |
| | | 9. Turnips. |
| | | 10. Barley and grass. |

To begin with turnips, without paring and burning, is uncommon; but if the grub be known to be in the land, and the landlord will not admit burning, it may be safely done with the skim coulter in the spring, and successive top scuffling for the crop, which thus succeeds well. Or the land may be dibbled with beans; and then to go on with barley and clover, &c.

1. Oats dibbled. *
2. Turnips.
3. Barley.
4. Clover.
5. Wheat.
6. Turnips.
7. Barley and gras.

Landlords, who hesitate about paring and burning, without being inclined absolutely to prohibit it, may stipulate for one of the two following excellent courses.

- | | |
|-------------------------------|-------------------------------|
| 1. Pare and burn for turnips. | 1. Pare and burn for turnips. |
| 2. Turnips. | 2. Barley. |

* It is not an easy matter to expatiate sufficiently (were this the proper occasion) on the excellency and importance of the dibbling husbandry. It saves two pecks of seed per acre (no inconsiderable object in a whole kingdom;) it gives a second harvest to the poor in wheat sowing; and a third in oats; and it is universally, on any fair average, attended with an increase of crop of from two to six bushels an acre: view this practice in any light, and it will be found highly deserving of the particular attention and encouragement of the Board. A man and his wife and six children will earn five, six, and seven guineas at wheat dibbling; and as much more by oats and pease and beans. No crop should be put in on a flag, or layer, or one unbroken earth, in any other manner. It far exceeds drilling; which, however, is a commendable practice in many cases.

- | | |
|----------------------|----------------------|
| 3. Barley. | 3. Clover. |
| 4. Clover. | 4. Wheat. |
| 5. Wheat. | 5. Turnips. |
| 6. Turnips. | 6. Turnips. |
| 7. Barley and grass. | 7. Barley and grass. |

In proportion to the dryness and lightness of the loam white pease are applicable.

1. Pease dibbled.
2. Wheat.
3. Turnips.
4. Barley.
5. Clover.
6. Wheat.
7. Turnips.
8. Barley and grass.

Potatoes are admissible; but, as they exhaust, they are to be guarded by a course which afterwards replenishes.

1. Potatoes.
2. Barley.
3. Clover.
4. Wheat.
5. Turnips.
6. Turnips.
7. Barley and grass.

With or without paring and burning these courses are safely to be depended on by a landlord: he needs not have the smallest apprehension of suffering; and they are such as no rational tenant can object to.

Caution.

In one or two cases only it is necessary to be prepared against accidents; these are, upon the supposition that turnips or clover should fail: in this case the land may easily suffer, if the tenant be not a good farmer.

The common practice in many countries, when turnips fail, is, to sow wheat at Michaelmas; but this is bad, for it deranges the whole rotation; and if the soil be at all light, the tillage is too much for wheat: better far to continue the fallow, and sow barley in spring.

If clover fail, the common way is to sow pease or tares broad-cast for a crop of seed; this I would by all means prohibit: if the crops prove great, and be thoroughly well managed, no harm ensues; but, with a middling crop, or bad management, the land is sure to be left foul; and if followed by wheat, becomes full of weeds: better therefore to stipulate either for turnips, and the barley and clover and wheat to follow; or tares to be sown, for soiling only; and then tillage for wheat. With bad farmers, or, indeed, with almost any, that have no leases, or only short ones, and who look only to spend little, but to get all they can from the land, there is no case in which a landlord suffers so much, as by the failure of clover; pease and tares for seed, and beans, not in perfect culture, very often fill the land with weeds; and yet the letter of the stipulations of the lease, or agreement, is adhered to. When a bad farmer knows, that, if his clover fail, he shall have so many more acres of corn, he is careless of seed, sowing, and every other circumstance; he ensures a failure; but if it brought on the expense of a turnip fallow, he would not repeat that grass so often; and would sow it only when he was sure of a crop. I have personally known such cases as I here allude to.

Sand.

In relation to courses, this soil, when rich, classes with turnip loams; the same rotations applicable: but when poor, and in the case of heaths, sheep-walks, &c. it varies.

Seven years.	Three yrs. Five years.	{	1. Pare and burn for turnips.
			2. Turnips.
			3. Barley and grass.
			4. Turnips.
			5. Barley and grass.
			6. Turnips.
			7. Barley and grass.

But in general this soil should always be in tillage, under some rotation that secures an ample stock of sheep.

1. Turnips.
2. Barley.
3. Grass.
4. Grass.

5. Grass.
6. White pease.
7. Wheat, barley, or oats.

- Or;
1. Turnips.
 2. Barley.
 3. Grass.
 4. Grass.
 5. Grass.
 6. Grass.
 7. Pease.
 8. Turnips.
 9. Barley.

But admitting great variations, according to circumstances. I have known heaths, and walks, and warrens, broken up successfully for potatoes; but, as they exhaust, they should be followed by replenishing crops of turnips and grass; as in the two preceding courses.

Chalk.

When downs, wolds, and chalky lands are permitted to be broken up, the landlord's chief object is, to secure as large a flock of sheep, or stock of cattle to be kept, as was upon the farm before such permission was given; nor is this difficult to be effected.

1. Pare and burn for turnips.
2. Turnips.
3. Barley.
4. Clover.
5. Wheat.
6. Turnips.
7. Turnips.
8. Barley.
9. Sainfoin; for not less than ten years.

Upon some soils the sainfoin wears out sooner; but still it may be kept for a sheep pasture, to the improvement of the soil for a fresh round.

1. Pease.
2. Oats.
3. Turnips.
4. Barley.
5. Grasses.
6. Grasses.
7. Grasses.
8. Oats or pease.
9. Turnips.
10. Barley and grass.

Peat.

Upon these soils I must consider paring and burning as essentially necessary, in order to attain the greatest and quickest profit to the farmer, and the public; and, by a proper course, without injury to the landlord.

1. Turnip, cabbage, or cole.
2. Oats.
3. Turnip, cabbage, or cole.
4. Oats and grass, or continued to eight years by
5. Clover.
6. Wheat.
7. Turnips, cabbage, or cole.
8. Oats and grass.

Potatoes are admissible; but, as they exhaust, are to be guarded by

1. Pare and burn for potatoes.
2. Oats.
3. Turnip, cabbage, or cole.
4. Ditto.
5. Oats and grass.

Before I dismiss this subject entirely, it may not be improper to make an observation on the alternate husbandry of grass and corn on arable land. This is not an uncommon system in Rutlandshire, &c.; and is a very profitable one: by loams laying to grass, and being well covered with sheep, they are prepared in the best manner for corn; and it is the same on fen and peat lands. The following is a proper course.

On soils inclinable to moisture,
or of good fertility.

1. Oats.
2. Turnips.
3. Barley.
4. Clover or winter tares.
5. Wheat.
6. Turnips.
7. Barley.
8. Grass ; for three, four, or five years.

On dryer land.

1. White pease and turnips.
2. Barley.
3. Clover.
4. Wheat.
5. Turnips.
6. Barley.
7. Grass ; for three years.

Loam grass, break up

1. Oats.
2. Turnips.
3. Barley.
4. Grass.
5. Grass.
6. Grass.

Grass, break up - -

1. Turnips. *
2. Barley.
3. Clover.
4. Wheat.
5. Turnips.
6. Barley.
7. Grass.
8. Grass.
9. Grass.
10. Grass.

* I have mentioned beginning with turnips, which is very uncommon husbandry, for the opportunity of noting, that it is excellent, provided turnips or cabbages be more wanting than another crop ; or the land be dangerously full of grubs ; the grass should be ploughed with the skin coulter, and then well scuffed ; turnip or cabbage then succeeds well, even without burning ; or if the turf be broken by a cross ploughing, and much harrowing, those crops take well amongst the imperfectly reduced sods. Rooks by this method have a good opportunity of clearing the land of grubs, &c. It is particularly applicable after any grass not at once extirpated ; such as chicory, of which some have on this account complained.

- Wet loams, break up =
1. Oats.
 2. Beans.
 3. Wheat.
 4. Fallow and grass.
 5. Grass.
 6. Grass.
 7. Grass.
 8. Grass.

Such husbandry must keep land in a constant state of fertility.

This alternate husbandry appears to be well understood in Northumberland: "By means of three years grasses depastured with sheep, the land will grow good crops of oats; which they could never get it to do under their old system: soil sandy, and dry light loams." * "Various systems have been tried in Northumberland, particularly the boasted course of 1. Turnips: 2. Barley: 3. Clover: 4. Wheat; till the crops have evidently declined, particularly the turnip and clover; and the only means of restoring such lands has been in the system of three years arable, and three years grass, depastured by sheep; by this mode, nature has time to prepare a sufficient lea-cud, which, being turned up for the turnip fallow, will insure a vigorous crop of turnips; as it is well known they always flourish upon fresh land, or where they find the remains of a lea-cud to vegetate in." † "The portion that is kept in grass for three years, breeds and fattens such a number of sheep, as leave a considerable profit; probably equal to, if not more than, the arable crops; the yearly profits of a sheep being estimated at not less than 20s. to 30s., six or eight of which an acre of clover will fatten; and an acre of turnips about double the number." ‡ This is to the credit of the Northumberland drill system, or the soil must be very extraordinary. "By this system" the author goes on, "are obtained the principal advantages of folding, without any of its inconveniences; for if, on an average:

The first year's clover and grass carry 7 sheep an acre, for 20 weeks,

2	-	-	-	5	-	-	20
3	-	-	-	3	-	-	20
And the turnips	-	-	-	12	-	-	20

That is - 27 sheep per acre for 20 weeks, which is

* *Corrected Report*, p. 64.

† *Ib.* p. 162.

‡ *Ib.* p. 163.

after the rate of 540 sheep per acre for one week once in six years, leaving 25s. a head profit."*

The great advantage of having land alternately under grass and corn, was known in this country in the time of the Commonwealth,[†] but in France much earlier.[‡]

A case to be provided for in these courses of crops, though not noted by the Board, is one that will often occur; that of a tenant requesting his landlord not to oblige him to lay down the same field which he has permitted to be broken up, but some other one exhausted by tillage; and as the request may in many cases be reasonable, (provided it be done after a course of crops similar to those prescribed in the preceding pages,) it ought not wholly to be unnoticed here.

It is in this case essentially necessary to pursue a good and meliorating course of crops, for some years, previously to laying down; unless such field be sown with turnips, cabbage, &c. two years in succession: the first well manured for; and both eaten on the ground with sheep, which are sufficient to do all for the land that any thing can do, except lying long under grass. With the barley or oats, after such two crops of turnips, the grass seeds to be sown.

On clay land the management should be different: the soil should be amply manured in autumn, or spring, when carting can be done without injury; but not later than May; one ploughing given in autumn; and three or four more in summer, previously to August; when the seeds are to be sown. I thus manured in autumn, and fallowed part of a field of wet cold loam; the rest fallowed, but not manured; and sowed both with the same seeds, chiefly meadow fescue, in August; and the superiority of the manured part was so great, that I do not conceive the dung could have been more profitably employed. The manure was ploughed in for winter tares, but other circumstances induced a variation of management, and this field was fallowed in order to be laid down instead of another.

With or without Corn.

In all these courses this circumstance is fully noted, by prescribing the spring crop with which grass seeds are to be sown; and in other cases by fallowing for grass, in which husbandry August is the season, and without corn.

* *Corrected Report*, p. 163.

† *De Serres*, 1629, p. 6.

‡ *Considerations concerning Common Fields and Inclosures*; 4to. time of the Commonwealth, p. 10.

Much has been written on the comparison of these seasons, and whether with corn in spring, or without it in August. But Mr. Lyster of Bawtrey compared them, and found the latter much the better. Mr. Dickson of Belford, made a comparative experiment, but all in the spring; four acres with grasses alone, on pease and buck wheat ploughed in the preceding autumn; five acres with barley, and five the seeds alone without either corn or manure. The two divisions sown alone were overrun with chick-weed, and would have been choaked, but a dairy of cows ate it. From that time, for seven years, no difference perceptible between the three divisions. The Earl of Holderness laid down large tracts of land both at Hornby-Castle and Sion, and found by experiments that the seeds answered best when sown alone.

Other authorities might be quoted, but the fact is, that the seeds will succeed almost equally well in either method; though if I did give the preference, it should be to August sowings without corn; but the success I have witnessed in both seasons, does not allow any positive opinion: moors and mountains are an exception; in such situations snows come too early to venture such sowings; on such I do not think that grass seeds should ever be sown in autumn; nor ventured later than the first week in August: but the better season is the spring, and with oats, not for a crop of corn, but following the too general advice of an Italian author, to mow it (before the seeds ripen) either for soiling or for hay. *

CHAPTER VII.

Of laying Arable Land to Grass.

IN the preceding detail of the courses of crops, those have been pointed out with which grass seeds should be sown; and the cases explained in which it is necessary to sow without corn; what remains upon this subject will therefore be properly examined under the following heads:

* *Elementi d'Agricoltura di Mitterpacher; Annotazioni relative all'Agricoltura Milanese.*
Tom. I. p. 307.

1. Preparation.
2. Seed.
3. Purchase of seed.
4. Sowing.
5. Autumnal management.
6. First year.
7. The case of failure.
8. Manuring.

SECTION I.—Preparation.

The greatest object, in this part of the business, depends on the course of crops, which is already dispatched; still, however, it ought to be remarked, that when grass-seeds are sown with a crop of corn in the spring, the tillage should be given with more than common attention; this will much depend on the turnips being eaten early; for, if that be delayed, and the weather should be unfavourable, the seeds will not be put into a bed of mould sufficiently fine, loose, and friable: the land should be ploughed for the spring corn thrice; and if the first of those earths be early enough to receive some spring frosts, they will be advantageous. Harrowing, or scuffling and rolling, are necessary, according to the soil; for, whatever that may be, the land should be well reduced for grass seeds. This attention is not so necessary for an August sowing; because the time and season give so ample an opportunity to prepare, that if the first earth had been given in autumn, the most negligent farmer can scarcely find any other difficulty than what arises from an uncommonly wet season.

SECTION II.—Seeds.

This is a very important part of the work, and for certain soils a difficult one, by reason of so few of the grasses being to be commonly purchased in the shops. I shall first detail the several plants, separately, with the soils they are proper for; and then propose certain mixtures and proportions.

1. Ray Grass (*lolium perenne*).

This grass, which for many purposes is a very valuable one, is chiefly to be recommended for the two divisions of soil distinguished by the Board under the

tides of loam, and sand. It will flourish on any land, except stiff clay; and will grow even on that; but, upon rich sands and loams, it becomes not only a good spring grass, but, if properly managed by due mixtures, turns out well as a permanent pasture land; always, however, most valuable by being sheep fed, for which it is singularly adapted. Mr. Peacey's two varieties of it are said by some persons who have tried them, to be superiour to the common sort.

Mr. Professor Mariyn states the *cynosurus caryoleus*; *poa nemoralis*; *bromus mollis*; *alopecurus*; *anthoxanthum*; and *poa pratensis*, as all being earlier than the *lolium perenne*, or ray. *

Yorksire White (bolcus lanatus)

Flourishes well on any moist soil, and grows very generally, except on the most dry and barren ones; where, however, it is also found. It should be sown chiefly with a view to sheep; for it is not equally good for other stock: many acres of it have been cultivated on this farm for sheep, and it has answered greatly when kept close fed. Mr. Marshall, in his *Midland Counties*, mentions it as a good grass for cows and other cattle; but bad for horses. † In his *York Economy* he condemns it in toto; probably from not then having so closely remarked its qualities. ‡

Meadow fescue (festuca pratensis)

An excellent grass for good loams and clayey soils; and I have found it abound largely on dry loams. I have laid down some parts of fields with it for comparison with other grasses on wet sandy loams on a clay marle bottom; worth 14s. or 15s. an acre; but have found it giving way in four years to the plants more indigenous to the soil. I do not think there is any better grass for either hay or pasturage; and it yields seed in great abundance. §

Meadow fox-tail (alopecurus pratensis)

For moist loams and clays there can not be a better grass; it is very early; it abides on this farm after nine or ten years on the soils upon which the *meadow fescue* gives way to others: it has also been found by Mr. Majendie hardier

* *Annals*. Vol. VI. p. 84.

† Vol. II. p. 148.

‡ Vol. II. p. 88.

§ Colonel St. Ledger was, I believe, the first who entered largely into the culture of this grass; and Mr. Majendie of Essex revived it, and began with the *alopecurus*.

against frosts than the *poa trivialis*: the greatest objection to it is the difficulty of getting the seed in any degree of plenty; there is an insect that feeds on it, and occasions much disappointment. Mr. Professor Martyn, in his excellent *Flora Rustica*,* speaks highly of this grass, and says, the seeds may be collected without much difficulty; but he does not there advert to the insect which is so pernicious, noticed by Mr. Majendie, and by the ingenious Mr. Swayne in his *Gramina Pasca*. In a field on this farm, where it is very well established, and the herbage thick, it produces very few seed stalks.

Crested Dog's-tail (cynosurus cristatus.)

To judge from the appearance of the bents of this grass in poor upland, but moist pastures, a man would think it a very unpromising plant; but the rich marshes of Bridgewater and Boston, the famous pasturages of Painton, in Devonshire, and those close to Mr. Buller's castle near Leskeard, in Cornwall, Mr. Thorne's bullock-grounds, on a dunstone bottom, near Tavistock, Mrs. William's at Little Malvern, in Worcestershire, (which are among the richest pastures in the kingdom,) all abound very greatly in this grass; in some of them it is the predominant herbage. Mr. Marshall places it as the most prevailing plant in the best grass meadows of the vale of Pickering, some of which will feed a large cow from Mayday to Michaelmas.† Very fortunately it abounds much with seed; so that I have had many bushels gathered in a season by poor women and children, at 1s. a pound, and laid down many acres with it successfully. Attention should be paid to its being ripe, for I once ordered eight bushels to be sown on eight acres, and it failed from deficiency in ripeness.‡

Poa trivialis.

Mr. Boys, of Betshanger, in Kent, has been the largest cultivator of this grass in the kingdom, and sold large quantities of the seed; but gave it up for want of a demand. It is an excellent grass on good, and sound, and moist loams. It is accounted in Lombardy "the queen of meadow plants, (*la regina dell' erbe*), whether for dry pastures or water meadows; multiplying itself much by seed, and

* Vol. I. † *York Economy*, Vol. II. p. 114.

‡ It is highly spoken of in the Milanese, *Atti di Milano*, Vol. II. p. 95. Vol. III. p. 287.

little by the root; so that, if attention be not paid to permit some seed to fall, its quantity will sensibly diminish. Excellent for all sorts of cattle." *

This hint concerning the seed is worth attention in England. Major Cartwright has found the *poa pratensis* to be an excellent grass on rich loams; and both succeeded well with Sir William Clayton of Harleyford.

Cock's-foot, (dactylus glomeratus,)

Has been largely cultivated over the farm I now manage, and to my satisfaction on wet loams on a clay marle bottom, upon which the finer grasses are apt to give way in a few years to the indigenous produce. If suffered to rise high, it is very coarse; but, fed close, is a very valuable sheep pasture. Women and children make good earnings in gathering it at 4s. a bushel. I have sown two bushels an acre, and 10 lbs. common red clover; and when the clover wears out, the grass fills the land, and abides well in it. It grows well in winter. †

Tall Oat-grass (avena elatior.)

This is another coarse grass, profitable when kept close fed: the seed might be had in any quantity from France; ‡ or gathered by hand in England. In the Rev. Mr. Swayne's experiment, it yielded a greater weight than any other grass. §

Timothy (phleum pratense.)

This grass is represented, by all travellers in America, as the great support of cattle, &c. wherever meadows are found; and it is ascribed to have considerable merit: I have several times made the trial of keeping it close fed by sheep on a moist loam, upon a clay marle bottom. The success was very encouraging; enough to prove that it is an object, in this line of husbandry, which merits considerable attention; and the more, as the seeds are to be had, very clean dressed, in any quantity from America, at about a guinea a bushel; which is sufficient, with

* *Atti di Milano*, Vol. II. p. 131, 314.

† Colonel St. Ledger found it very profitable as an early food for sheep. *Young's Eastern Tour*, Vol. I. p. 274. In Southern Georgia nature beginning to form on the rocks a thin coat of soil, only two plants would vegetate, *dactylus glomeratus*, and a kind of burnet, *sanguisorba*. *Forster's Voyage Round the World*, p. 38.

‡ The French writers speak of it in high terms: they get 20,000 lbs. of hay per journal, common grass giving 2,000 lbs. *Obser. Soc. de Bretagne*, 1759, p. 46.

§ *Gramina Pastura*. Folio,

other plants, for four or five acres of land. * I believe it is best adapted to clay, moist loams, and especially peat.

Yarrow (acbillæ millefolium,)

One of the most common and most valuable plants that is to be met with in England. On this farm the cultivation of it has been carried on with success as a sheep pasture for some years. It is found on moist loams, almost equally with dry burning sands, gravels, and chalks. It has a singular quality of resisting drought on the most arid soils, so that if you see at a distance a green spot on a burnt up close-fed pasture, twenty to one but it is clothed with this plant. It is found in the richest meadows and bullock pastures. Five shillings per bushel are given for gathering the seed in October: it is a plant which deserves great attention. Sheep are very fond of it. †

Burnet (poterium sanguisorba.)

There are large tracts of the finest parts of the South Downs upon which this plant forms half the indigenous pasturage. It abounds much also on all other chalk downs; but it will flourish on any soil; on sand, clay, peat, &c. Some writers speak of it for cows: it has been cultivated on this farm these five and twenty years for sheep; for which animal it is very useful: the seed is every where to be bought.

White Clover (trifolium repens.)

This plant has hitherto been the main dependance of those who have laid down land to grass; and though for sheep, it has not the sweetness of some other plants,‡ or of red clover, yet, upon the whole it is one of the best that can be relied on

* Roque says, 4lbs. an acre, and I sowed that quantity once, but found it much too little. *Practical Treatise on Lucern*, p. 44. Bowden gives a very great character of this grass. *Farmer's Directory*, p. 139.

† It forms a fourth part of the herbage of some of the fine meadows of Lombardy. *Atti della Società Patriotica di Milano*. Vol. III. p. 266.

‡ Mr. Bakewell made this observation; also Mr. Wright of Norfolk, and several other practical farmers. Stock has been known to do badly, though much food on the ground; perhaps that is precisely the reason; and that this plant, like so many others, demands very close feeding to discover its merit.

for all rich or dry loams, sands, &c. ; and also for rich and drained clays, and peats ; but on poor wet loams and clays, it will not abide, but gives way to the water-grass, (*Agrostis stolonifera*.) and noxious plants, or other indigenous grasses. There is no better test of good land than its running spontaneously to this plant ; from the fine loams on rock upon the Tamar, to the deep friable ones of Leicestershire, red clover, left unploughed, gives way to a thick covering of this plant. Whatever seeds be sown, this clover should form a part of the dependance for success.

Trefoil (medicago lupulina.)

Though only a biennial, it is sure to shed so much seed that it rarely wears out of land. It is a good plant, not at all nice in soil, and the seed cheap.

Cow-grass (trifolium medium,)

An excellent plant for clays and strong loams. It is said, in the Lincoln Report, that Mr. Ancel got good crops on a rabbit sand ; the hint is worth pursuing ; but I have not seen it cultivated on such soils. It is much more abiding than common clover. The seed is always to be had : it is known also under the name of marle grass. Mr. Bakewell's method of laying down was by common red clover and ray-grass, being sure of plenty of white clover and good grasses coming ; but he prepared by two crops of turnips in succession ; and sowed with the barley following. On such land as his, the practice is not to be condemned ; but on other soils it would fail entirely.

Rib-grass (plantago lanceolata.)

Upon rich sands and loams this plant gives a considerable herbage ; and on poorer and drier soils it does well for sheep ; but it is inferior to some others. Mr. Marshall observes, that it has stood the test of twenty years established practice in Yorkshire, and is in good estimation ; though not well affected by horses, and bad for hay, from retaining its sap.* The eminent Haller informs us, that the astonishing richness of the famous dairies of the Alps, described by Scheuhzer, is attributed entirely to the plenty of this plant, and the *alcemilla vulgaris*.† The seed is always plentiful.

* York Econ. Vol. II. p. 92

† Iter Helveticum. Pultney Gen. View, p. 398.

Lucern (medicago sativa,)

More confined than any of the other plants. A landlord should only stipulate for it on very rich, deep, friable, dry, sound, mellow, loams, and fertile sands worth gos. an acre. Upon such lands he cannot do better than to encourage it among the tenantry, to be sown broad-cast, 20 lbs. an acre, and to remain while productive, which will be from 12 to 15 years. On such soils it will support more cattle than any other plant.

Hay-seeds.

The only case in which these are admissible is, when a person has a very clean and valuable meadow or pasture which he saves with a view to the seed; drawing out the bad plants whilst the crop is on the swarth, and thrashing the produce on a cloth, after standing till the seeds be ripe. Thus managed, excellent seed may be procured.

These plants may be thus arranged :

<i>Clay.</i>	<i>Loam.</i>	<i>Sand.</i>	<i>Chalk.</i>	<i>Peat.</i>
Cow grass.	White clover.	White clover.	Yarrow.	White clover.
Cock's-foot.	Ray.	Ray.	Burnet.	Dog's-tail.
Dog's-tail.	York white.	York white.	Trefoil.	Cock's-foot.
Fescue.	Fescue.	Yarrow.	White clover.	Rib.
Fox-tail.	Fox-tail.	Burnet.	Sainfoin.	York white.
Oat-grass.	Dog's-tail.	Trefoil.		Ray.
Trefoil.	Poa.	Rib.		Fox-tail.
York white.	Timothy.			Fescue.
Timothy.	Yarrow.			Timothy.
	Lucern.			

however with some latitude; as it may generally be received as a safe maxim, that the more seeds are sown, the better, provided inferior plants be not assigned to land that will produce better: thus, in the column of *loam*, *Yorksire white* should not be sown, provided the four following grasses in the column can be had in quantity; which may not be the case.

There are many other plants, some of which have been tried under my direction,

which deserve much attention; but I have not named them in the above mentioned list; because the seed cannot be procured but with difficulty: some perennial vetches, clovers, melilots, lotuses, &c. &c.; several others are highly spoken of by some writers, yet as my own trials have not been equally successful, I am not authorised to recommend them. I never tried the *vicia sepium* sufficiently to give an opinion of it; but, by Mr. Swayne's account, it deserves much attention.* I do not think the Board could more essentially serve the Public than by establishing a farm, and cultivating these, and other plants, for supplying seed to their members who wished to cultivate them: a very little land would be sufficient.

In regard to the quantities per acre of these plants, this must necessarily depend on the means of getting them. In situations where women and children are fully employed, it may be difficult to procure large quantities, gathered by hand; in such places a man must be content with what can be bought. *Crested dog's tail* is so very generally to be thus procured, that I cannot but suppose it, in a good measure, at command. However, without adverting to this point, I may remark, that from the lands which I have laid down to grass to a considerable extent, and in which I have used every one of these plants largely, except the *poa*, and that on a smaller scale, I am inclined to think that the following quantities may be safely recommended.

Clay.

Seeds.

Cow grass, 5 lbs.
Trefoil, 5 lbs.
Dog's-tail, 10 lbs.
Fescue, one bushel.
Fox-tail, one ditto.

Substitutes.

Yorkshire white, two bushels.
Timothy, 4 lbs.
Ditto 4 lbs. or York white, one bushel.

Loam.

White clover, 5 lbs.
Dog's-tail, 10 lbs.
Ray, one peck.

{ Ray, one peck.
Rib grass, 4 lbs.

* *Bath Memoirs*, Vol. III. p. 71.

<i>Seeds.</i>	<i>Substitutes.</i>
Fescue, three ditto.	Yorkshire white.
Fox-tail, three ditto.	Timothy, 4 lbs.
Yarrow, two ditto.	Cow-grass, 5 lbs.

Sand.

White clover, 7 lbs.	
Trefoil, 5 lbs.	
Burnet, 6 lbs.	
Ray, one peck.	
Yarrow, one bushel.	{ Ray, one peck.
	{ Rib, 4 lbs.

Chalk.

Burnet, 10 lbs.	
Trefoil, 5 lbs.	
White clover, 5 lbs.	
Yarrow, one bushel.	Ray, one bushel.

Peat.

White clover, 10 lbs.	
Dog's-tail, 10 lbs.	York white, six pecks.
Ray, one peck.	
Fox-tail, two ditto.	Rib, 5 lbs.
Fescue, two ditto.	Cow-grass, 4 lbs.
Timothy, one ditto.	

But here I must observe generally, that if the land, thus laid to grass, be intended for sheep, it is not an object of very great consequence to sow only the finer grasses; as close feeding, after the first year, will make any grass named in these lists fine, and sweet, and productive; but this effect depends altogether on its being constantly fed close; that is, all seed stems being prevented from rising. Every good farmer is sensible of the necessity of this with *ray-grass*; but most unaccountably does not extend a similar concern to other grasses. Above 200 acres under my management have been laid down chiefly for sheep; and I have stocked the fields so early in spring, and so thickly, as just to keep down the seed stems; the *cock's-foot*, *oat-grass*, and *Yorkshire white*, with this management,

have proved sweet feeding grasses, not at all rejected, even in fields where the flock had a choice. Several writers seem to have been very sensible of the consequence of close feeding.

Mr. Davis says, "The sweetness of the feed on the downs of Wilts, depends much more on its being kept close, and eaten as fast as it shoots, than on any particular good quality of the grass itself; for there are many downs that, when close fed, appear to be a very sweet pasture; but which, if suffered to run a year or two without a full stock on them, will become so coarse that sheep will almost as soon starve as eat the grass." *

"Upon Benlomond, &c. the pasturing of sheep has evidently, in the course of 20 years past, improved the quality of the herbage, so as to raise grass of a good species, and in very considerable abundance, where nothing formerly prevailed but bad kinds of grass, and these in no great plenty; and the practice bids fair to banish heath from all the places that are pastured by sheep." †

Lisle, who was the best writer of husbandry we had for many ages, remarks; "That there are poor soils which require a much longer time to grow a second inch than the first; and that, consequently, on such it is much more profitable to keep sheep than cattle." ‡ The writer of this Essay, on first reading this passage, made the experiment on land of 12s. and 15s. an acre; clipping the plants with scissors, and carefully measuring and weighing the produce, and comparing it with neighbouring plants left to perfect the seed stem: the superiority was proportioned to the times of cutting.

Sheep-feeding not only ameliorates, by enriching the soil, and fining the herbage, but also by destroying weeds. *Ragwort*, with which the bullock-grounds of Limerick are over-run for want of sheep, is much affected by them; and Mr. Marshall gives an instance of a meadow, foul in the extreme with *knobweed*, cured by pasturing it repeatedly in the spring with sheep. §

But here a counter remark must be made, which is, that after a field has been pastured long with sheep, and close fed, it becomes unable to yield a growth of hay: the plants, by being constantly cropped down, acquire a dwarfish habit; however quick the growth in that early stage. There is a small field on this estate which has been under grass time immemorial, and kept fed for the last 40 years at

* *Wilts Report*, p. 18.

† *Stirlingshire Report*, p. 49.

‡ Vol. II. p. 79.

§ *York Economy*, Vol. II. 128.

least; except one year in which it was mown, expecting a vast crop: the season was very favourable, but I was utterly disappointed, for the produce was small. I have known the same thing happen on inclosing an old common. In Scotland a similar remark has been made. "Two inclosures of the same soil were laid down together with grass-seeds of the same kind: after two years hay, the one was surrendered to pasture: from the other a crop of hay was taken every other year. After seven years absence, the proprietor returned home; and, wanting more hay, mowed both, and that, which had been pastured, gave the worst crop."* Something like the same thing has been observed in Switzerland. †

3. Purchase of Seed.

This inquiry by the Board may seem to some persons rather an odd one, from the interest of the tenant being so great a call to him to spare no expense for that crop which is to last at least as long as his lease; but the hint is wisely given; for long experience in every part of the kingdom proves, that of all other works this in general is the worst executed by tenants: they sow the cheapest seeds which can be procured, that is, common clover, and ray, or the rubbish of their hay loft; the clover gives a crop the first year; but as it wears out, all sorts of trumpery succeed, if the soil be not good enough to run spontaneously to white clover. For this reason the prudent landlord will never fail to stipulate, that he or his steward should provide the grass-seeds at the tenant's expense.

About 25s. will purchase the seeds in most of the preceding instances: the expense may be reckoned from 20s. to 30s. but depending on various circumstances, as the state of markets, and the price of labour.

Of the seeds recommended, the following are to be bought in any quantity.

Cow-grass.
Yorkshire white.
Timothy, from America.
White clover.
Trefoil.
Ray.
Burnet.
Rib.

* *Wightl*, Vol. IV. p. 478.

† *Memoires de Bernes*, 1763, Tom. III. p. 130.

Dog's-tail and cock's-foot are so easily gathered by hand, that no difficulty can occur in procuring them. Meadow fescue, cultivated for seed, yields it so simply, that in a short period that also may be commanded.

4. *Sowing.*

Seedsmen are apt to mix seeds of nearly the same size in order to have the fewer casts. This is a very bad way, and should always be guarded against. Five pounds weight of any clover, &c. cannot be divided and sown at two casts; but 10 lbs. may, and ought; and, if the quantity be larger, it is better sown at three; but, for all small seeds, the Norfolk turnip trough, which is now adapted to clover and ray-grass, is much the better way of delivering these seeds. Those of grass which are light ought never to be sown in a windy day; for an equal delivery is a point of great consequence. All grass-seeds should be covered at one tining of a very fine light pair of harrows. Of all other circumstances, sowing in the wet, so as to have the least degree of poaching or stickiness, should be avoided.

5. *Autumnal Management.*

This is a point of considerable consequence; and in proportion to the moisture of the soil. All trampling by cattle and horses is pernicious; for the soil, after a crop of corn, or after the tillage of a fallow, is very tender, and affected by every impression: it is also bad to feed the plants, as I have found by some experience. The safe way is to keep every thing out, through both autumn and winter. The point of feeding is absolutely nothing; for the pasturage in the spring for sheep, is of far more value, by reason of not eating it in autumn: at the former season it affords a most valuable and very early bite for ewes and lambs.

6. *First Year.*

In this point there is a great difference of opinion: some have contended that the new lay should be pastured by sheep; others, by cattle; others, that it should be mown for hay; and others, seeded.

In the North Riding, the best farmers feed their new lays with sheep the two first years.* If ray-grass and white clover be meant to remain some years, a Gentleman in Strathern, of superiour knowledge, eats them the first year with sheep; which

* *Report*, p. 48.

renders them thick, close, and durable. * To let in heavy cattle the first year does mischief, which demands years to recover. †

If mown, it should be early cut; for nothing is worse for new layers than the grass running to seed. ‡

Mr. Wright of Ranby pastures them with beasts the first year; as sheep do harm. §

Dr. Wilkinson compared sheep feeding, with mowing, experimentally; and the superiority of the former was very great. ||

The Marquiss of Rockingham seeded them the first year. ¶

Colonel St. Leger fed the two first years with great success. **

The Earl of Egremont, (every feature of whose husbandry testifies the perfection to which he has brought it,) upon breaking up the lawn in front of the mansion of Petworth, relayed it with different grasses; and notwithstanding the horses and cattle, sheep and deer, with which at all times of the year the park is very heavily stocked, pared the young plants close to the ground, from the earliest period after sowing, yet the grasses shot up very soon, and covered the ground so abundantly, that this part of the park is not to be discovered from the remainder, excepting perhaps by the superiority of its herbage

All these methods have been practiced under my direction; the last merely for gaining the seed for other lands; nor have I the least doubt upon the question; if the grass be kept unfed in autumn, and it be not turned into, too early in the spring, sheep do no harm, but much good; the number should not be so great, nor kept so long, as to allow the plants to be nibbled too close; but sheep feeding is certainly the best for the first year. If bents rise, as they will do, let them be swept with a scythe before any of them seed, unless the plants be evidently too thin on the ground; in that case the seed falling may do more good by raising fresh plants, than harm to those which yield the seed. Though I have little doubt that feeding is the right management, yet it is not to be concluded that, with mowing, the grass will not succeed; Lord Rockingham's new lays, viewed in the autumn of the first year, were, by description, among the finest that have been seen; they were manured however the autumn after sowing, which is admirable management, provided the soil be sound, and the season very dry.

* *Perib.* p. 44.

† *De Serres*, p. 223. *Clemente*, p. 20.

‡ *Phil.* xviii, 28. *Mazwell*, p. 254. *Wight*, 1, 243.

§ *Nottingham Rep.* p. 25.

|| *Annals*, 15, 347; 20, 462.

¶ *Young's Northern Tour*.

** *Eastern Tour*.

But it is not only the first year that sheep-feeding is the best management for a new lay ; it should be so fed also the second year, and if the third, so much the better ; there is no necessity of continuing it longer : but I have had some fields under my care which succeeded well in feeding four, five, and even six years ; and in general it may be laid down as a rule, that the more the land is sheep-fed, the more it will be improved ; and especially, if it be ever to be ploughed again for corn. But when sheep-feeding inclosures are mentioned, it is understood, that the sheep are not to be removed from such fields to be folded elsewhere ; a ruinous, impoverishing, unnecessary system ; of which the farmers are too fond, as they are of every way of robbing grass to favour corn.

7. The Case of failure.

If the recommendations given in this Essay be closely attended to, there is very little reason to apprehend a failure ; however, as it is possible from extremely unfavourable seasons, something should be said on it.

Such a failure can scarcely happen to more than one or two of the sorts of seed : in this, or indeed in any case of failure, fresh seeds should be sown in a moist time in the spring, and if a flock of sheep can be driven over the land, it will be a good way to cover them ; if not, it should take its chance ; for a roller will not so well effect it, and a harrow cannot enter without mischief. If a very large fold (five or six yards to a sheep) be run over a field, once in a place, and the seeds sown before the sheep enter, success is almost certain. At least I have seen the benefit of thus thickening new lays, in seasons not peculiarly favourable.

Should, however, a total failure from any unforeseen cause take place, the better conduct will be, in fields that were sown in the spring, to clear the corn as early as possible ; and, ploughing once, to harrow in fresh seeds immediately : these will succeed very well, if they be got in during the month of August ; the sooner the better ; and, in this case, the land should be very well rolled in October, in a dry season. If the failure happen on land sown in August, it should have three earths in dry weather in the spring, and the grass-seeds re-sown with buck-wheat in May. It is not a crop for clays and wet loams ; but I have known it succeed well in a dry summer : should the season be wet, it will give little seed, and should be mown when in blossom, for soiling cows. It is an ameliorating plant, never exhausting any soil ; and therefore preserves in the land the fertility gained by the operations

previous to the former sowing. And I may here generally observe, that grass-seeds of all sorts, and on all soils, never succeed better than with buck-wheat; of which not more than one bushel an acre should be sown. There is a district in Norfolk, where buck-wheat is highly valued for this object. It is a profitable article of cultivation on the very poorest barren sands.

8. *Manuring.*

This part of the management will not be found essential, if the land be laid down in the courses prescribed; it, however, will at all times be found very beneficial. The best time for it is in August or September, if done the first year; being then a year old, when a moderate dressing will much promote the thickening of the herbage. But, upon soils rather unfavourable to grass, on which the success is at all doubtful, I should prefer (if it can be done but once) to delay it to the period when new lays are apt to fall off, that is in August of the third year, if fed; but, if mown, immediately after clearing off the hay, which is the best time of all others for manuring grass land.

Top dressings of soot, sifted ashes, malt dust, and other bodies which will wash in the first heavy rain, should be sown the end of February, or beginning of March.

CHAPTER VIII.

Of the Covenants for securing the preceding Husbandry.

THIS is a subject which, so far as respects legal security, a public Board must have much better means of information than the individuals who are likely to communicate Essays; but for the material objects which should find their way into these covenants, it is necessary to add the skeleton of some. It will be best to suppose * the permission to break up, given by an endorsement, or addition to a lease already existing.

* Any person who has read attentively the reports for counties, written by the Gentlemen of Scotland, must have remarked an uniform condemnation of the inserting of covenants in leases for

Clay.

The within-named lessor doth hereby covenant and agree, that the within-named lessee shall have permission to break up and plough the field called ——— containing ——— acres; provided, and in consideration that he the lessee abide by, execute, and perform the following stipulations, covenants, and conditions: that is to say, the within named lessee doth engage immediately from the date hereof, at his own proper cost and charge, well and sufficiently to drain the said field, by digging, or by ploughing and digging 160 rods of drains to every acre, not less than of the depth of 30 inches; and to fill the said drains in a neat husbandlike manner, one-third of the depth with ———; and, having finished such draining, shall plough up the said field, and crop it only, and in no other manner than the following; that is to say, in the spring of this year, 1801, shall plough once, and dibble in beans on every other furrow, giving at least two hand-hoeings, and three horse-hoeings, or broad sharings, or shimmings; and, keeping the said crop perfectly clean and free from weeds, shall, after the beans, crop the land with oats or barley, on three earths, sowing clover or other grass with the same; and shall plough for, and sow wheat upon such clover lay for the crop of 1804. But in case the said clover or grass should fail, then the said lessee shall not sow any other crop whatever on the said land for the crop of 1803, saving winter or spring tares only; such tares to be mown for soiling, and not suffered to seed; and, as fast as cleared, the land to be ploughed, and three earths given for the ensuing wheat. And shall, after such wheat, give a complete fallow from autumn 1804, to August 1805,

the regulation of the tenant's husbandry. Adam Smith calls them "imperinencies," and would, in a varying land-tax, estimate them at the highest value in rent. By the circumstance of the Board demanding covenants, it is to be presumed, that respectable Body has not adopted such ideas. It is to be hoped they never will adopt them: for a landlord, in an improved English county, could not conduct his estate in that manner, without running a great hazard of declining rents. I suspect that improvements on a large scale are of a modern date in Scotland; and that, when the country is more advanced, these notions will naturally give way. Leases are guards against bad farmers; and such are every where to be found; but in a less improved country, the object is not of equal consequence, for any cultivation is, in such, a gain. A rational lease only confines bad tenants to a rotation which good ones would pursue without a covenant. But in the point of breaking up grass lands, covenants are necessary to all: what madness it is to argue that such a point should be left to the option of a tenant!

ploughing the land once before winter, and at least three times 'in the ensuing summer; and shall, in August, sow the same with such grass-seeds as the said lessor shall provide at the expense and charge of the said lessee, not exceeding one pound five shillings per acre; and shall not, under any pretence whatever, mow, or feed, or pasture the same with any kind of live stock, before the 1st of April following; and shall not, after the said 1st of April, or through any part of the summer or autumn ensuing, mow the same, nor pasture it with any kind of stock, sheep alone excepted. And in case the said grass-seeds should fail, then the said lessor engages to furnish, at his own cost and charge, not less than one pound five shillings per acre of other seeds, for the same to be sown at the time required by the said lessee; but no crop of any kind to precede, or to be mixed or sown with the same.* And the said lessee covenants, and engages, that all straw, or hay, or dung arising on the said land so broken up and cropped, and the new grass land thus laid down, shall be subject, in its use and application, to the covenants respecting the other lands of the within-demised premisses.

Loom.

Covenant for a seven years course.

The within-named lessor doth hereby covenant and agree, that the within-named lessee shall have permission to break up and plough the field called _____ containing _____ acres; provided that he the lessee abide by, execute, and perform the following stipulations, covenants, and conditions; that is to say, the within-named lessee doth engage to till, and crop the said field, in the manner following: to give it one ploughing in the spring of the present year, 1801, and thereon to dibble or put in a crop of oats. To plough at least four times for turnips in 1802; which turnip crop not to be carted off, but fed on the land, with sheep only: and if such turnips should fail, to sow no crop in lieu of them, but continue the fallow for the barley, or oats of 1803: and on no account to sow wheat on the land. To sow clover with such barley or oats for the year 1804; and if such clover should, from any cause, fail, to sow no other crop instead thereof, but only winter or spring tares; such tares to be fed with sheep, or mown for soiling; and on no

* The husbandry would be to sow with oats in the spring; but not to be allowed in the covenant, that the tenant may not have a direct interest to cause a failure, in order that he might have a crop of corn on the fallowed land.

account allowed to perfect their seed. To plough for, and sow wheat for the year 1805. To plough at least four times for turnips in 1806; which turnip crop not to be carted off, but fed on the land with sheep only; and if such turnips should fail, to sow no crop in lieu of them, but continue the fallow, ploughing at least four times more for the barley or oats of 1807: and on no account to sow wheat on the land. To sow with such barley or oats such grass-seeds as shall be provided by the said lessor, at the expense, cost, and charge of the said lessee, not exceeding one pound five shillings per acre; and shall not, under any pretence whatever, mow, or feed, or pasture the same with any kind of live stock, before the 1st of April following; and shall not, after the said 1st of April, or through any part of the summer or autumn ensuing, mow the same, nor pasture it with any kind of stock; sheep alone excepted. And in case the said grass-seeds should fail, then the said lessee engages to summer fallow the said land; ploughing at least four times, till the August following, that is to say of 1808, and then sow on the same, without other crop, such grass-seeds as the said lessor shall provide at his own proper cost and charge, not less than one pound five shillings per acre. And the said lessee covenants and engages, that all straw, or hay, or dung arising on or from the said land so broken up and cropped, and the new grass land thus laid down, shall be subject in its use and application to the covenants respecting the other lands of the within-demised premises.

Peat.

It is not deemed necessary to insert the forms for sand and chalk, as the aim of the covenants is seen in the two preceeding cases; but that of paring and burning being a direct variation, it may not be amiss to insert the covenant.

For eight years.

The within-named lessor doth hereby covenant and agree, that the within-named lessee shall have permission to break up, pare and burn, and plough the field called ——— containing ——— acres, provided that he the lessee abide by, execute, and perform the following stipulations, covenants, and conditions; that is to say, the within-named lessee doth engage to till and crop the said field in the manner following: to pare, burn, and plough it in the present year 1801; and to sow thereon either turnips, cabbages, cole, or rape. If turnips, to hand-hoe them twice, in a husbandlike manner; if cabbages, to keep them through the year

perfectly clean by as many hoeings as are necessary for that end; but not less than two; which turnip, cabbage, or cole, not to be carted off, but fed on the land with sheep only; and if such turnip, cabbage, or cole, should fail, to take the earliest opportunity of resowing the same, as no other crop or crops to be substituted in lieu thereof. To give at least three ploughings to the said land for oats for the crop of 1802. To give at least four ploughings, and sow the land with turnip, cabbage, or cole, in 1803, under the same covenants and limitations as for the same crop in 1801; paring and burning alone excepted. To plough at least three times, and sow oats in 1804; with which crop to sow clover, to be ploughed up for the wheat of 1805; but if the said clover should fail, to sow no other crop in lieu thereof, but only winter or spring tares; such tares to be fed with sheep. To plough for and sow wheat for the crop of 1805, and to plough at least four times, and sow turnip, cabbage, or cole, in 1806, under the covenants and limitations of the same crop in 1803. To plough at least three times for sowing oats in 1807; and to sow with such oats such grass-seeds as shall be provided by the said lessor, at the expense, cost, and charge of the said lessee, not exceeding one pound five shillings per acre; and shall not, under any pretence whatever, mow, or feed, or pasture the same with any kind of live stock, before the 1st of April following; and shall not, after the said 1st of April, or through any part of the summer or autumn ensuing, mow the same, nor pasture it with any kind of stock, sheep alone excepted. And in case the said grass-seeds should fail, then the said lessee engages to summer fallow the said land, ploughing at least four times till the August following, that is to say, of 1808; and then sow on the same, without other crop, such grass-seeds as the said lessor shall provide at his own proper cost and charge, not less than one pound five shillings per acre; and the said lessee covenants and engages, that all straw, or hay, or dung arising on or from the said lands so broken up and cropped, and the new grass land thus laid down, shall be subject, in use, application, and duration, to the covenants respecting the other lands of the within demised premises.

The writer of this Essay is no lawyer, and therefore may have failed greatly in his manner of expressing new ideas: but as the Board of Agriculture must possess far superiour means of procuring such forms, in which the introduction of penalties would constitute a material object, he is not so solicitous to frame them free from legal objections, as he is to explain the husbandry which they require to be pursued.

CHAPTER IX.

Of the Rules by which Additions of Rent should be estimated.

THIS I consider, of all the questions put by the Board, as by far the most difficult to answer. To offer general assertions or vague conjectures, would be to leave the subject as we find it; at the same time the difficulty of approaching correctness is so great, that I am not able perfectly to satisfy myself, much less am I likely to meet the ideas of so respectable an assemblage of enlightened cultivators.

The method, and the only one which occurs to me is, by calculating the produce of the land in question under grass, and then under corn; to allow half that produce for the rent, tithe, and poor rates of the grass; and one-third as the rent, &c. of the arable: this will not in all cases be exact, or fair; but it is, upon the whole, coming nearer to the truth than any other general rule that strikes me as easy to be explained.

If rent, tithe, and rates be not thrown together, the calculation would run into confusion; besides, rent must, in the nature of things, depend on those other charges. To apply this rule, let us suppose that a landlord gives permission to a tenant to plough up a grass field on a loam soil, let at present at 15s. an acre landlord's rent only: producing, it may be supposed, about 40s. and that he prescribes the second course of crops mentioned before under that division of soils; viz.

1. Oats.
2. Turnips.
3. Barley.
4. Clover.
5. Wheat.
6. Turnips.
7. Barley and grass.

All he has to do is, to estimate the probable produce of this rotation. Suppose

	£.	s.	d.
1. Oats six quarters an acre, at 20s.	6	0	0
2. Turnips - - - - -	2	10	0
3. Barley five quarters, at 24s.	6	0	0
4. Clover - - - - -	3	0	0
5. Wheat $3\frac{1}{2}$ quarters, at 48s.	8	8	0
6. Turnips - - - - -	2	0	0
7. Barley four quarters and a half, at 24s.	5	8	0

Suppose the straw 10s. a crop *	33	6	0
	2	0	0

Deduct the expense of grass-seeds for laying down; suppose	85	6	0
30s. the landlord losing 5s.	1	5	0

Divide by 7) 34 1 0

Produce per annum 4 17 5

One-third for rent, tithe, and rates	1	12	5
Suppose tithe - - - - -			
Rates - - - - -	6	0	
	0	11	0

Remains for rent - 1 1 5

Those, who think tithes are not prejudicial to agriculture, may examine such cases as these. Let us calculate this instance again, and suppose the tithe taken in kind.

* In some situations and years, straw rises from 10s. even to £ 10. an acre; but in many others, indeed through the larger part of the kingdom, it is to be considered as an object of very small profit, farther than as the means of raising manure. If it be sold to much profit, it should be estimated higher than I have supposed in these calculations.

	£.	s.	d.
One-third as before for rent, tithe, and rates	-	-	1 12 5
Produce - - - - -	35	6	0
The tenth for tithe - - - - -	3	10	7
The seventh of which	0	10	1
Rates - - - - -	0	6	0
			0 16 1
Remains rent - - - - -	0	16	4

Here, in one case, the landlord has an adequate inducement of 6s. 5d. additional rent; in the other he has 1s. 4d. which only could induce him to let the land remain in grass. In one case he would consent to breaking up, in the other he probably would not: the tithe of the grass produce, taken in kind, could amount at the utmost to between 4s. and 5s.; but from the arable that sum is more than doubled; while the Rector therefore would get above 5s. an acre, the landlord would have only 1s. 4d. From this comparison it appears, that the Gentlemen who are apt to think tithe a small matter, when called only a tenth, (a proportion which they think has but little influence on the nine-tenths remaining,) mistake the matter; the preceding is evidently a case in which 10s. 1d. the tithe is measured with 26s. 5d. in one proportion being not far from two-fifths, and with 16s. 4d. rent in the other, in which it is much above half. Compare the tithe with another object, the farmer's profit; if his farm be stocked at £5. per acre, and he make 12 per cent. it is 12s. Will any person contend that 10s. 1d. is not a sum that will in any branch of industry in the world have a material influence by its proportion to 12s.? Throw rent and profit together, 33s. the tithe is near to one-third. Those who measure it with gross produce only, talk idly; the produce is not the motive that influences the various applications of land, but the rent and profit; and if tithe bear a large proportion to these, it bears a powerful influence on the conduct of those who direct the product of the soil. If the farmer's stock be only £4. an acre, (and more land is stocked with that sum than with £5.) his profit is 9s. 7d.; that is less than the tithe of the same land: this is not the place for calculations to prove that the profits of husbandry should be estimated by a per centage on capital employed and as to 12 per cent. no one will think the proportions unfair at average prices.

The author of this Paper has a due veneration for the church, as sincere a veneration as those may have, who are violent against any commutation; he wishes prosperity to its temporal concerns; but he sees tithes in what he conceives to be the just light, and cordially wishes their possessors to receive their emoluments in some mode free from the numerous objections to the present method of paying them.

But to return from this digression: it appears by this account, that the landlord may, in such a case, have a fair compensation for breaking up such land, in the additional rent of 6*s.* 5*d.* an acre; which is a considerable rise on 1*s.*: as to that of the grass, after being again laid down, it will depend on the success of the new lay; but one rule should never be departed from, on no account to sink the rent on any pretence: there is a certainty of its being much better than before tillage, for two years at least; and fully equal for those two years to the rent paid while arable; afterwards it may decline, if it be not manured; but the probability is, that any tenant would bind himself for liberty to plough, to pay the arable rent for two years; and then the addition of 1*s.* 2*s.* or 2*s.* 6*d.* according to the soil, for the remainder of the lease; and I am clearly of opinion, that he would lose nothing by so doing.

This rule of estimating the rent, and the preceding calculation, will appear much too low to those who do not throw high prices of corn, &c. entirely out of the question; if I offered any calculation in reference to such prices, it could only have the effect of deceiving some, and leading others into gross errors; into such errors as those men plunge into upon speculation, who hire farms on the credit of the present prices: the only degree of speculation admissible, would be generally to estimate that prices are rising, by which I mean, when taken on the average of seven years. I have calculated at 20*s.* 2*d.* and 48*s.* a quarter, as the last ratio of a steady price; but I admit, that, at present, there is no probability of the next seven years, including 1801, being on a medium so low, and, consequently, it would be fair for a landlord, in estimating the rent he took for liberty to plough, to calculate on higher prices than those. If he had been disposed to take the prices of twenty, thirty, and sixty shillings, (which perhaps it might be fair for him to do, and to which his tenants would certainly agree,) the estimate would then be as follows:

	£.	s.	d.
1. Oats six quarters, at 20s.	-	-	6 0 0
2. Turnips	-	-	2 10 0
3. Barley five quarters, at 30s.	-	-	7 10 0
4. Clover	-	-	3 0 0
5. Wheat $3\frac{1}{2}$ quarters, at 60s.	-	-	10 10 0
6. Turnips	-	-	2 0 0
7. Barley four quarters and a half, at 30s.	-	-	6 15 0
			38 5 0
Straw 10s.	-	-	2 0 0
			40 5 0
Grass-seeds	-	-	1 5 0
			7) 39 0 0
Produce <i>per annum</i>	-	-	5 11 5
Rent, tithe, and rates, one-third	-	-	1 17 1
			Tithe - 5s. 0d.
			Rates - 6s. 0d.
			0 11 0
			Remains for rent - 1 6 1

by which he would gain 11s. 1d. per acre for seven years at least; and the farmer make a handsome profit.

The following cases, with which the writer of this Essay is accurately acquainted, confirm the idea of one-third of the gross produce being a fair allowance for rent, tithe, and poor rates.

Wet loam on a clay-marle bottom.

Produce;	1.	Fallow.	£.	s.	d.
2. Barley four quarters, at 24s.	-	-	4	16	0
3. Clover	-	-	2	0	0
4. Wheat $2\frac{1}{2}$ quarters, 48s.	-	-	6	0	0
Two crops straw	-	-	1	0	0
			4) 13 16 0		
			3) 3 9 0		
For rent, tithe, and rates	-	-	1	3	0

The rent in this case (before the scarcity) was 15s. the tithe 3s. 6d. and the rates 4s.

The same s. il.

Produce;	1. Fallow.				£.	s.	d.
	2. Wheat $2\frac{1}{2}$ quarters, 48s.	-	-	-	6	0	0
	3. Oats three quarters, 20s.	-	-	-	3	0	0
	Two crops straw	-	-	-	1	0	0
				2)	10	0	0
				3)	3	6	8

For rent, tithes, and rates - - - 1 2 2

The rent in this case 13s. 6d.; tithe 4s.; rates 4s. 2d. The lease expired; a new tenant took it, who hollow-drained the land, and farmed in other respects better.

Produce;	1. Turnips on about half; the other half fallow				1	0	0	
	2. Barley four quarters, 24s.	-	-	-	4	16	0	
	3. Clover	-	-	-	2	5	0	
	4. Pease and beans three quarters, at 24s.	-	-	-	3	12	0	
	5. Wheat $2\frac{1}{2}$ quarters, 48s.	-	-	-	6	12	0	
	Three crops straw	-	-	-	1	10	0	
					5)	19	15	0
					3)	3	19	0

For rent, tithes, and rates - - - 1 6 4

The rent was 16s.; tithe 4s. 6d.; rates 4s. 2d.

Sandy loam on a gravel bottom.

Produce;	1. Turnips	-	-	-	-	2	0	0
	2. Barley $4\frac{1}{2}$ quarters, 24s.	-	-	-	-	5	8	0
	3. Clover	-	-	-	-	2	15	0
	4. Wheat three quarters, 48s.	-	-	-	-	7	4	0
	Two crops straw	-	-	-	-	1	0	0
					4)	18	7	0
					3)	4	11	9

For rent, tithes, and rates - - - 1 10 7

The rent in this case was 21*s.* ; the tithe 5*s.* ; and rates 4*s.*

An observation which cannot be impressed too much on this subject is, that poor rates must, beyond all question in the long run, come out of the landlord's pocket. They are in these estimates taken at 6*s.* an acre ; but are in many parishes double and even treble, and they are every where rapidly rising : one effect of their height and rise is, that of inducing and forcing almost every where careful valuations of parishes, in order that so heavy a burden may be fairly born. This is not inequitable ; but it will have most mischievous effects on the agriculture of the kingdom, for a varying rate is a direct and heavy tax on improvements : these calculations shew, for instance, that if rates be high, the landlord would not give his consent to plough ; and for the plainest reason, he would make nothing by it. If, instead of 6*s.* an acre, they be 12*s.* they take his whole profit on the first scale of prices, and they take more than half on the higher scale : such rates, and the tithe taken in kind, or at the value, would utterly prohibit tillage, by depriving him of his motive to permit it : and be it remembered that, in these estimates, nothing is reckoned for additional buildings and repairs ; which, though difficult to be estimated, would certainly come to something.

This enormous burthen of poor rates cannot receive too much attention from the legislature ; for no question of tillage, the price of provisions, the state of the lower classes, or indeed the general state of the kingdom, can become a topic of inquiry, without this most momentous subject being closely connected with it. In proportion to their advance, is the idleness and evil habits of the poor, and, with both, their wretchedness and misery. If some very effective cure be not speedily adopted in a new system of support, the industry and morals of the people will suffer to an alarming degree. Rents will rise only to be dissipated, to encourage habits of reliance that will deprive the lower classes of the best principles of self support ; and every class will be impoverished for no other purpose but to disseminate idleness, and to perpetuate poverty. Not an hour should be lost in taking this subject into serious and deep consideration.

CHAPTER X.

CONCLUSION.—*On the Effects which may attend a great increase of Tillage.*

THE ideas which have been floating in the public mind relative to the degree of the present scarcity, as distinct from price, have varied a good deal in the last five months; * during which the crop of 1800 has been consuming. Early in that period the reality of the scarcity was greatly doubted; as thrashing and sowing advanced, the opinion seemed to change. For the last two months I think I remark a fresh variation in these opinions; and they have tended to go back to the former idea; this is not surprising, for the price of wheat has been so enormous as to lessen the consumption immensely, by bringing the people to eat barley, oats, pease, beans, rice, and every sort of substitute; and this change has raised the price of all these articles so much, that there can be no doubt of every thing having been consumed with the most severe economy; five months of such economy must have had no slight effect in giving rise to the ideas which seem at present to be gaining ground: still, however, the price does not fall; and for this some reasons might be given were they properly the subject of this Essay; the longer the price continues high, the larger the stock in hand must be (whether little or much) at the commencement of next harvest. The breadth of wheat sown is uncommonly large; should it please God to bless the nation with a productive harvest, and good weather, I should not be surprised at seeing wheat fall suddenly, as it did after the scarcity of 1796; but, at all events, two good successive years would give such a stock in hand as to render the millers and corn dealers masters of the markets, as they were (very much by means of importation) from 1771 to 1794; and, in that case, all encouragements of tillage would be futile: price would have a greater power; and, by discouragement to tillage, would infallibly occasion, under our rapidly increasing population, successive famines. I am here treading on what may be called legislative ground; but as the Board demands information in consequence of a legislative requisition, it can hardly be deemed an impropriety to offer a few remarks on this very important prospect, which ought certainly not to be kept out of view.

* Including January, 1801.

If it had been possible to ensure a steady price of corn, the desirable ratio would be, wheat at 7s. 6d. a bushel; barley half the price of wheat, or 3s. 9d.; and oats one-third, or 2s. 6d.: the profits of the farmer, when under these prices, are too little; and, after poor rates have been reduced from their present extreme, would probably be nothing at all. Now, by the present corn laws, the bounty ceases when wheat is 44s. the quarter, or 5s. 6d. the bushel, and export itself at 46s.; a most false *datum* being admitted, that any higher price would be an evil. Import at low duties (the same as being free) takes place if wheat be at 50s.; though, by the old laws, it paid a considerable duty till it was at £4. in the home market. If such laws be continued, the kingdom must experience alternate cheapness and famine.

A new system must be formed; and if, in the framing of it, due attention be not paid to the rise of poor rates, and the price of labour, no efforts will ever command plenty.

These considerations seem to indicate, that a much higher average price of corn, than what we have experienced for the last 30 years, is essentially necessary.

If apprehensions be entertained, that such price would press too much on some among the very poorest classes, which are certainly the labourers in husbandry, (though it would much deserve attention that if low prices produce famines, they are no more to be desired by the poor, than by the rich) it then becomes another consideration, whether some measure should not be embraced to ease their situation in this particular point. Such an object might be very difficult to effect; but the importance of it would at least merit a serious attention.

✓ Potatoes are a root of perhaps more true efficacy in easing the situation of the country poor than any other plant to be named; but, unfortunately, they are not cultivated by cottagers to one hundredth part of the extent in which they ought to be. In some cases their gardens are too small to be worth attention; in others the rent is too high; in others they have none at all: in very few are potatoes made a due resource. In Ireland the immense benefit flowing from every cottager raising his own potatoes, is a circumstance long understood, and felt. If any method could be devised to oblige or induce landlords to establish this system, in such a manner as would enable the country poor to support themselves for only half the year without dependance on bread, the advantage would be almost incalculable. Wheat always yields the worst crop in wet summers, potatoes the best.

The produce of one would tend to supply the deficiency of the other, in years when such deficiency might press heavily. I shall not presume to assert that this system could be brought into effect; but if great doubts had been entertained, it should seem, that there is scarcely an inquiry more deserving the attention of the Board of Agriculture, than into the means of rendering such a system general.

Should nothing effective be done relatively to either of these objects, I have great apprehensions that any encouragement to break up grass lands generally, will have mischievous consequences; ever excepting wastes, and grass fields on dry soils that evidently want the plough as the means of improvement. Should the present high prices of corn tempt landlords to permit much ploughing, where it is not really necessary, I have not the smallest doubt but they will suffer by it in the end.

And as the Board would certainly desire to avoid giving advice which may prove eventually unfortunate, I humbly presume to add, that they cannot consider the subject too deeply, in all its most remote bearings and connections, before they offer any recommendations that shall have the least indiscriminate effect. If an increase of tillage be found essentially necessary, at a hazard, the waste lands of the kingdom are the proper subject for it, and by no means converting grass lands to tillage, which are advantageously employed at present; and which would admit, perhaps, the radical improvements of draining and manuring, very profitably, in their present situation.

The future condition of the landed interest, as connected with the objects of this Essay, well deserves the consideration of every man whose prosperity depends on that of the agriculture of the kingdom. Those who are dazzled at the advantages of the present moment, which exceed, perhaps, what is commonly thought of, if they be induced to look forward to a great rise of rent, will probably be deceived. The temporary evil of high prices will cause such a variety of means of preventing a return of it, that if these have the smallest operation, in union with one or two plentiful crops, the reverse, to be expected, will be distressing; and the more so, as it will, without much attention to guard against it, produce the return of famine. The people in great districts will have acquired the habits of eating substitutes; the growth of potatoes will have greatly spread; rice will be largely stored; the waste lands perhaps cultivated, by means of a General Inclosure; tithe perhaps will be commuted, which would alone turn much land to tillage: combine all these circumstances, with a good crop, perhaps with two good crops, and an active im-

portation, what may we expect the price of corn to be? An increase of population will be the only favourable drawback from so many causes of depreciation; but the experience of 1797 and 1798 proves that this is not to be depended on. This prospect rises to our view, united with a great advance in labour; in wear and tear; in tithe; in taxes; and in poor rates; all permanent circumstances in a degree, though arising from a merely temporary cause. To all these, if landlords add a considerable rise of rent while prices continue high, we shall, by and by, see effects we little dream of at present. Very much will depend on wise regulations of the export and import of corn; a subject which ought at present to be in contemplation; for it will demand an union of talents and industry, for the deepest consideration. It must therefore be highly important, that so respectable a body as the Board of Agriculture, whose opinion must have great weight, should have right ideas on a subject with which the prosperity of the landed interest, and eventually of every other, is so intimately connected.

*An Essay on the Means of extending the Cultivation of Corn on Strong Lands,
without diminishing their Value, or lessening the Production of Animal Food.
By the Rev. Edmund Cartwright.*

No. IX.

An Essay on the Means of extending the Cultivation of Corn on Strong Lands without diminishing their Value, or lessening the Production of Animal Food.
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THAT farm, it is obvious, is the best managed which yields the greatest produce at the least expense. And it may be laid down as an axiom, that no farm, which has its resources only within itself, can yield the produce that a tillage farm will, on which the crops are so judiciously diversified, as to keep such a stock of cattle as shall supply it with manure. A farm, so conducted, may be made not only to produce plentiful crops of grain, but actually to support as large, and in many cases larger, stocks of cattle, than the same compass of ground would have done, were the whole to have been in grass. And this is the true point of view in which agriculture should be looked at, both by landlord and tenant; as holding out to the one the prospect of increasing profit; to the other that of an improving income. To this point also, as an object of political economy, should every legislative regulation and encouragement, if they ever interfere, be directed.

At present too much land is exclusively appropriated to pasture. In consequence of which, other causes also co-operating, grain has gradually been increasing in value, and is now become alarmingly scarce. Were a contrary system, however, not judiciously conducted, to take place, there would then be a deficiency of animal

food; a deficiency which, from the prevailing habits of life, would be equally distressing; and, indeed, more so, as it could with more difficulty be supplied.

Happily for the community, in this instance, as well as in most others, private interest coincides with public duty; though prejudice too frequently prevents the coincidence from being noticed.

An indiscriminate use of the plough is, however, by no means recommended: the strong feeding lands, such as will fatten an ox of seventy, or even sixty stone (fourteen pounds to the stone) per acre, ought rarely to be meddled with; neither should the superiour kinds of meadow land, nor land subject to inundation, or which, from its relative situation, admits not of complete drainage; as such land, in winter time particularly, must be frequently inaccessible. There are other lands also, which, from their incorrigible barrenness, will never repay the expense of tillage. There is no danger, however, of any practical farmer wishing to disturb them.

Respecting those lands which are proper for turnips, the mutual advantage, both to landlord and tenant, in occasionally subjecting them to the plough, is so obvious, and at the same time so well understood, that it would be superfluous to insist upon it. And yet I have been told, and by a gentleman too of the first agricultural information in the kingdom, that there are at this day innumerable sheep-walks, both in Suffolk and Norfolk, let at present for only two shillings and sixpence per acre, which the proprietors have refused to have put into a course of tillage at a rent of ten shillings per acre, and upon a one-and-twenty years lease!

The lands, more particularly locked up from the plough, are all those gradations of soil comprehended between strong clay and unctuous loam; those lands, in short, which are not adapted to turnips, and on which sheep cannot be folded to consume the turnips with advantage. It is a received opinion, that on this sort of land the plough can rarely be admitted without injury.

It is the intention of this Paper to point out how lands of this description, that is to say, all those gradations of soil between strong clay and unctuous loam, may be so advantageously managed, while under the plough, as to afford the landlord an increase of rent, and be again converted to pasture without debasement of its quality.

It may be necessary to premise, that nothing will be here stated, which is not the result of actual experiment, personal knowledge, or repeated observation, or else of such well authenticated information as may be confidently relied on.

Whoever intends breaking up land, containing the least particle of clay, need not be told, that it is essentially necessary to lay it as dry as possible; not only on account of the crop intended to be grown upon it, but for the conveniency of getting upon it at all times with the plough, carting on manure, and carrying away the produce.

The privilege of paring and burning ought never to be granted to a tenant, who is not under lease, or on whom his landlord cannot place implicit confidence. Where the privilege is in no danger of being abused, it may safely be indulged in.

In performing this operation, care should be taken to do it with a smothering heat; for if the fires are too intense, the ashes will be of inferior quality. The advantages of this practice are numerous: it in a great measure annihilates seed weeds; it is destructive to many kinds of insects, and other vermin, noxious to agriculture; it decomposes whatever comes within the sphere of its activity; and the ashes it produces neutralize the soil, and assist in the farther decomposition of the vegetable and animal matters contained in it; and these substances it converts into suitable food for the future crop. Its operation on the soil is something analogous to the operation of malting on grain: as malting disposes the grain to part freely with its most nutritious principle, the saccharine matter, so will paring and burning dispose the soil profusely to part with its nutrition to the plants which are committed to it; and this it will do, not for a single year only, but for several years, according to its original degree of fertility, in succession; and if the crops are exhausting ones, till it is soon worn out. Hence on pared and burned land, more so, perhaps, than on any other, no two exhausting crops should follow each other.

In Derbyshire, and that part of Yorkshire which borders upon it, and probably in many other parts of the kingdom, which I am not able to speak to, it is not unusual to pare and burn as a preparation for wheat. And if the wheat be followed by turnips, rape, cabbages, or potatoes, according to the nature and quality of the soil, and the manure, they respectively may have produced, returned to it, there is not much to be reprehended in the practice; though it would certainly be better to reverse it, and let a fertilizing crop take the lead. When this is done, and an exhausting and a fertilizing crop are taken alternately, the land when laid down again to grass, provided it be judiciously performed, will be in better condition than when first broken up.

If you commence your operations with paring and burning, you are obviously to be regulated in your choice of the season for performing it, not only by the intended crop, but by the weather, and the moist or dry state of the soil itself. If the work can be executed, which sometimes it may be, early in spring, your first crop, provided the soil be not too stiff, may be potatoes, which may be followed by wheat. Rape, turnips (to be drawn off) or cabbages present themselves, if you are not early enough for potatoes. Should your choice fall on the two former, the ground may be cleared time enough for wheat: if on the latter, barley will be your next crop. The crops to succeed wheat are, drilled beans, pease and beans mixed, or tares, to be mown green, or eaten off upon the ground. Many object to tares on cold clayey soils, as being too backward in spring, a time when green food is certainly most valuable. On such soils, it must be confessed, they cannot be made that advantage of, which they may be on warm sands, or rich loams; nevertheless they may on the coldest soils be made to answer a very beneficial purpose. They may either be eaten off by sheep, or mown green for horses, milch-cows, young stock, and even hogs. When eaten off by sheep, the sheep should have access only to part of the field at a time, and should be shifted to a fresh part every week, ten days or fortnight, as occasion may require. They ought also to be driven to a grass field at night, or folded, where folding makes part of the agricultural system. For working horses they are excellent. A farmer, whom I knew in Leicestershire, used to maintain his horses entirely, and other cattle in part, upon tares for two months in the season. A great part of his farm, on which he sowed tares indiscriminately, was a cold clay. I have frequently heard him speak of them as one of his most valuable crops. Where the tares were off time enough, he sowed turnips. After the later-mown tares, the land was fallowed to be ready for barley in the spring. His turnips were drawn off. The great objection to winter crops, requiring to be carted off, exclusive of the labour, is the injury that is oftentimes done by cutting up and poaching the ground by the cart and horses. The person I have just spoken of, as soon as the land grew miry, laid aside his carts, and used sledges, which, having an extended base, will slide aloft, where a cart would sink and be laid fast.

A better method, however, has been adopted by a friend of mine in Derbyshire, the greater part of whose farm is of that kind of soil which will not admit of the

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winter crops being eaten on the ground. He has his land ploughed into narrow ridges of such a determinate width as to allow the wheels of the carts, which he uses for drawing off his winter crops, to run in the furrows. His horses, or oxen, draw double, and the shafts of the carts are at such a distance apart, as that the animals go in the furrows also. By this contrivance, the labour of drawing off the crop is much reduced, as both the horses and earriage go upon the firmest ground, and the land is not so much cut up and poached. There is no disadvantage in the ridges being narrow; on the contrary, the narrower the ridges, if properly formed, the drier they will be. This practice, wherever it can be adopted, is well worth attending to, as it removes a great difficulty and objection to the growing winter crops on clayey or other soils, where they cannot be eaten on the ground.

A different, and, it is possible, a still better method has been suggested to me by one, of whose knowledge and experience as a practical farmer I have reason to think highly, and consequently feel disposed to pay a deference to any speculative idea he may throw out on this subject. He proposes either to make use of moveable sheds, (such as they have in Flanders,) but with the addition of a floor of watted hurdles; or else to have an open fold, with a floor of the like kind. Were this practice to be adopted, a space should be first cleared of the crop to be consumed, equal to the size of the intended fold. The food must be given in racks or cribs. As fresh ground is cleared, a fresh fold should be prepared. The hurdles, which composed the floor of the first fold, will be getting dry against they are wanted a second time.

The advantages attending this contrivance would be many: the sheep would be kept out of the mire, neither would the land be cut up nor poached; and the trouble, expense, and inconveniency of carting the food from the field, and bringing the dung back again, would be saved, as in this case it would be deposited where it was produced. Some inconveniencies might probably arise which do not immediately present themselves: perhaps, where the hurdles lay hollow, there might be danger of their breaking; perhaps it might be uncomfortable for the sheep to lie down upon them. The expense would not at all events be great; the price of hurdles, three yards long by one wide, is in general not more than six or eight-and-twenty shillings a score. Allowing each sheep two square yards, the flooring of a fold that would contain an hundred would cost between four and five pounds. With care

they would last at least two if not three seasons; and even when no longer fit for their original destination, they would not be without their value as fire-wood.

The idea, as it is new, will by many no doubt be treated as visionary. But as it may be brought to the test of experiment for a few shillings, upon a small scale, it would be no great waste of time to ascertain its practicability. Were it even to fail, it is possible it might suggest some farther idea, by which the object in view might be accomplished.

Much has been said and written on the subject of rotation of crops: if the rotation be such, as to take in alternately an exhausting and a fertilizing one, it seems to be of little consequence, (except, perhaps, in the case of wheat following clover,) in what order they succeed each other.

By exhausting crops, every one knows, are understood, wheat, rye, barley, and oats; by fertilizing ones, crops of every kind which are consumed upon the land, or mown or carried off before they perfect their seed, and which are brought back again in the state of manure. Pease and beans also, though scarcely fertilizing crops, properly so called, have an ameliorating tendency, by smothering weeds, and by leaving the soil in a moist and open state, proper for the reception of wheat.

On strong lands the following courses I have known successfully practised:

Beans,
Wheat,
Cabbages,
Barley,
Clover;

this course presents three ameliorating crops to two exhausting ones.

Potatoes,
Wheat,
Turnips (carried off,)
Barley, and sometimes oats;

this was a very common course about twenty years ago in a bleak part of Derbyshire, where I formerly resided.

Wheat,
Tares, and afterwards turnips,
Barley,
Clover, or

Wheat,
Tares,
Oats,
Turnips;

these were the general courses, with few deviations, observed by the Leicestershire farmer mentioned before.

It admits not of a question, that an acre of clover, tares, rape, turnips, or cabbages, will furnish at least twice the food that the same acre would have done, had it remained in pasture; by any one of these courses, therefore, it follows that the land would maintain, at least, as much stock as when in grass, besides producing every other year a valuable crop of corn. No calculation is made upon the value of the straw, which, whether consumed as litter, or as food, will add considerably to the stock of manure.

That the condition of the land would be improved, there can scarcely remain a doubt upon the mind of any man, who will consider the subject attentively. The plough, by pulverizing the soil and breaking its tenacity, not only gives admission to the fertilizing influence of the atmosphere, but by intimately mixing the manure, prevents that tenacity from taking place in future, so long at least as the manure remains totally unexhausted. But as the soil will have a fresh and ample supply every other year, the stock of manure, with its concomitant fertility, will rather accumulate than be diminished; in consequence of which, whenever it is again converted into pasture, it will be in superiour condition to what it was when first broken up.

A principal circumstance, which the land-owner has to attend to, is the laying down his land to grass. On this being well or ill executed, will greatly depend its future value. It is needless to observe, that it ought to be in the best possible condition, contrary to the practice which formerly prevailed of cropping the ground, so long as it would produce any thing; and then suspending the plough, till such time as the land recovered itself. A summer's fallow on all tenacious soils, should always precede the sowing of permanent grass-seeds.

It has been much disputed, whether land should be laid down with a crop of corn, or with grass-seeds only. Which method would be attended with the more immediate profit, admits not of a question; and as that profit affects the public, as well as the farmer, and without any apparent injury to the proprietor, the argument

preponderates in favour of laying down land with a crop of corn. Both methods, however, I have seen practised with success.

The great error in laying down land to grass, stiff land particularly, is not allowing seed enough.

Previously to its being laid down, the land should be got into very fine tilth, and well manured, with the addition of lime and vegetable ashes of any kind, if they can be procured.

Various opinions prevail respecting the kinds and proportions of the different grass-seeds to be sown. I knew a gentleman, whose farm, which was an extensive one, consisted chiefly of strong rich clay, all of which I may assert to have known, at one time or other in tillage; indeed, I do not recollect, scarcely a single field, except what was subject to inundation, which had not been broken up and laid down again more than once, within my own memory. His practice was to lay down with a crop of barley, and to sow *14 pounds of white clover, a peck of rib-grass, and three quarters of bay-seeds* per acre. By this liberal allowance of seed, he always secured a thick coat of herbage the first year, which differed from old pasture only in being more luxuriant.

It was his opinion, and his practice was in conformity to it, that no land was injured by the plough, if judiciously managed; for though it might not carry, for the first year or two, such heavy cattle as it would afterwards, yet he always found that in the mean time, it would support and fatten more in number of a smaller size.

I mention this instance, as not only coming within my own immediate knowledge and daily observation, (for, indeed, I stood in the nearest degree of relationship to the person alluded to, being one of his family,) but as it proves that strong clay land may be broken up and brought back again into grass, not merely without injury, but with advantage.

In breaking up old pasture, of which the soil is clay, should paring and burning not be approved of, the first crop may be beans sown broad cast under furrow, or what is better, dibbled in: these are to be succeeded by wheat. As soon as conveniently may be after the wheat is harvested, the land should be prepared for a winter fallow, and if cabbages are intended for the future crop, ploughed into three feet ridges. In performing this operation, the ridges should be laid as high and narrow as possible, the furrows wide and open. In this form, the ridges will receive the

full influence of the air, sun, and frost; and by the furrows being wide and open, the water will run off immediately as it falls.

In the beginning of April, dung should be laid in the furrows and covered by the plough; by which means, the furrow and ridge will change places. Cabbages, which are intended to be consumed early in winter, should be planted out about the latter end of April, or as soon as the ground can be got ready, the seed being sown in July or August preceding. They should be planted on the ridges three feet asunder, and horse and hand-hoed when necessary: if a succession be wanted till late in the spring, the planting should continue at intervals, till the beginning of July. The late-planted cabbages should be raised from seed sown in February.

The American drum-headed cabbage is the best for the first crop; for spring use, the Scotch cabbage is preferable, as being more hardy and less disposed to run to seed early in the season.

Cabbages are much cultivated in many parts of the kingdom, particularly in Leicestershire and Lincolnshire, where they are given to sheep, especially to ewes and lambs in the spring, and are greatly preferred to turnips, where the soil is too moist and adhesive to admit of the turnips being eaten off. There is no stock they may not be given to with advantage, whether milch-cows, feeding cattle, or stores.

A gentleman in Lincolnshire, who grows them upon a large scale, calculates a fair crop of cabbages at £12. per acre. I have frequently given them with great advantage to milch-cows and young cattle; but not attending to the circumstance at the time, am not able to speak to their value when applied to that kind of stock. In giving them to milch-cows, care should be taken to strip off all decayed leaves, otherwise they communicate a very disagreeable flavour to the milk and butter.

Land which has produced cabbages, will be in suitable condition for barley; to which, in regular course, will succeed red clover. The course may then recommence as before, or the beans may be omitted. In situations commanding lime, the lime should be applied after the cabbages. In the place of cabbages, tares or rape may be substituted, should they more conveniently accommodate themselves to the exigency of the farm.

Beans and wheat alternately I have known tried, and with success; manuring for the beans every other course. But I think this course inferior to the former one, as it does not afford its due proportion of food for cattle, (unless indeed, the

beans are all consumed at home,) and consequently would not effectually furnish the necessary supply of manure.

Potatoes and wheat have been recommended, and which I have known practised upon a small scale for some years. It is now, I understand, in that part of the country where I formerly knew it practised, in a great degree laid aside, under the idea, that repeated crops of potatoes impoverish the soil. I rather believe, when long persisted in, they render the soil of too loose a texture for wheat.

There seems to be no reason why a limited time should be prescribed for continuing strong land under tillage. Indeed, from every observation I have been able to make, I should conclude, that so long as the tillage was conducted upon a right principle, so long would the soil not only retain its original fertility, but, in some degree, would be advancing in improvement. That strong land is not injured even by continual tillage, we may have a convincing proof by only adverting to any of the new inclosures, which have taken place in our own memories. We shall find upon examination, that those lands which had been well managed, though they had been under tillage for centuries, are, now that they are laid down in grass, as good land as the adjoining fields, which have probably never been disturbed for ages.

There is a certain degree of exhaustion which every soil will bear annually without any perceptible injury, and which is uniformly regulated by the innate fertility of the soil itself. Nature, however, has providently contrived, that where that degree of annual exhaustion, which the soil will sustain without injury, is exceeded, little farther is required to enable it to recover itself, than that it should have rest or lie fallow: that this is a fact, we need only look at those open fields where the common course is wheat, beans, fallow. What reason is there to suppose the soil less fertile now, than it was formerly? If it be not less fertile, what but the fallow year restores it? It is true, the fallow is commonly assisted by a dressing of manure; but if with no other manure than the land itself furnished, it is in no degree adequate to the robbery the soil must have sustained by producing two crops of grain in succession. We may, therefore, conclude that if the fallow, assisted by the manure the preceding crops had produced, did not completely renovate the soil, common fields would long ago have been reduced to a *caput mortuum*. But what puts this renovating property of a fallow out of all controversy, is a fact recorded by Mr. Young.* The practice he speaks of prevails also, I have been informed, in some parts of Essex.

* Agricultural Survey of Lincolnshire, p. 107.

If, therefore, land will recover the exhaustion of any single year by a year's fallow, we may reasonably presume it will more than recover what it has lost, by producing a crop which shall not only not exhaust, as no crops are supposed to do gathered green, but at the same time, shall supply a large stock of manure.

What is it that has so much improved within this last half century, the value of light soils, but the introduction of that system of agriculture, which prescribes an alternation of exhausting and fertilizing crops? Before the turnip husbandry was introduced, a great deal of light sand land was scarcely worth cultivating. The introduction of that vegetable alone has improved the value of such property in most cases three and four fold; and in many instances, ten and even twenty fold. I am aware, that the improvement may be attributed not only to the plentiful supply of manure, furnished by a turnip crop, but from the soil being consolidated by the trampling of the cattle in consuming it on the ground. This advantage, it must be confessed, clay land cannot have, neither does it stand in need of it; for, indeed, the consolidation which sand land wants, it already possesses and commonly in a greater degree than is necessary. Fertilizing crops, which are not consumed where they grow, have a natural tendency to counteract the adhesive quality of strong soils, both by loosening the soil, and by the repeated ploughings they acquire; so that, besides the benefits they have in common, the advantage which sand land derives in one way by the production of a fertilizing crop, clay land obtains in another.

There seems to be no question that barley is in general the fittest grain to be sown with grass-seeds. The same tilth, which answers for the one, is requisite for the other. Barley has a disposition to loosen the texture of the ground in which it grows; a circumstance highly favourable to the vegetation of grass-seeds, which require a free and open soil to extend their roots in; the tender and delicate fibres of which, have much difficulty in contending with the resistance of a stubborn soil. And this points out the reason why grass-seeds so frequently fail on strong land, not in a proper state of cultivation. There is, however, little danger of their success, when the ground has been well fallowed in the preceding summer, (which it ought always to be, previously to its being laid down) and brought into fine tilth and condition. In the choice of barley, that sort should be preferred which runs least to straw, and which is the soonest ripe.

It is a practice with several in laying down land to pasture, to confine themselves

solely to the artificial grasses, under the idea that along with the hay-seeds, they run the risk of stocking their fields with many useless, if not noxious, plants.

It is not to be denied, that along with the hay-seeds are sown the seeds of many plants, which ought certainly, if they could be, to be excluded. But if with these, you exclude also the natural grasses, you deprive your pasture of its most valuable herbage.

It is much to be wished that the different kinds of natural grasses, as they are called, were to be cultivated apart, together with such other plants, of which there is variety, as cattle are observed more particularly to affect. Were this once done, and the properties of the different grasses and plants carefully ascertained, with regard to their several tendencies to fatten, to stimulate appetite, or promote digestion, such a combination might be formed as to produce pastures superiour to any that are known at present. Till that period, however, shall arrive, hay-seeds, it is to be hoped, will retain their station, care only being taken, which, indeed, is a matter of the utmost importance, to collect them from hay-ground of the best quality.

As soon as the barley is harvested, it will be of great service to the infant plants to draw a moderately heavy roller over them, provided the ground be dry, and yet in that state as not to be altogether insensible to the impression of the roller. Unless it be very luxuriant, no stock should be suffered to pasture upon new grass on any account, till the following spring: and before cattle are then turned upon it, it should be suffered to get a good head, and it should never be eaten bare.

I have not known many instances of new grass being mown the first year after sowing; and in the few in which I recollect the practice, it was chiefly with a view of obtaining seed to lay down other fields with. The expedient, I remember, answered exceedingly well. The grass being of good quality, and suffered to stand till the seed was perfectly ripe, the crop was abundant. It was thrashed out, and the hay (which, indeed, was little better than straw) given to the cattle in the fold-yard. The seed being arrived at maturity, and not heated, as common hay-seeds are apt to be, in the stack, there is reason to conclude that every grain, thus saved, would vegetate. What was the immediate effect on the field from which they were gathered, in the few cases I speak of, I cannot now charge my memory with. Had

it been any thing perceptible, I have no doubt I should still retain some impression of it.

As the tenant has had his advantage in breaking up the soil, it seems reasonable he should be at the expense of the grass-seeds for laying it down again; though, perhaps, it would be expedient for the landlord to furnish them, charging them to the tenant. He would thus be certain of the proper sorts and quantities being applied. For though it is the interest of both landlord and tenant that the land should be properly laid down, yet as the former has not only a present but a permanent interest in the event, he has a double inducement to take care that the business is properly executed.

Nothing would be more easy than to prescribe "a rule by which an increase of rent might be computed, where permission is given to break up old pasture now under lease," provided the future profits of the tenant, in consequence of such permission, could be accurately ascertained, and compared with the profits he makes at present. Could this be done satisfactorily, equity would direct that the increased profit should be divided between the landlord and tenant in equal proportions, a deduction being made for the tenant's trouble and exertion, in obtaining it. It would be no unreasonable allowance to set apart one-third of the increased profit as an equivalent for the extra trouble and exertion of the tenant. But as the whole must be a matter of unavoidable contingency, depending not only on the variation of seasons, but fluctuation of price, the landlord ought certainly to content himself with a much less proportion than one-third. Supposing a calculation to be made upon the average chance of increased profit, twenty, or at the most five-and-twenty, *per cent.* on that calculation seems to be no inequitable compensation; and it would add still more to the equity of it, if this compensation were reduced to a corn-rent.

It will be observed, that in this Essay I have confined myself solely to the consideration of strong soils, improper for the common course of turnip husbandry. But the same arguments, which are made use of to shew the expediency and policy of occasionally ploughing up strong land, will apply with more than equal force in inculcating the necessity of ploughing up soils of a different quality, were any arguments, indeed, wanting to recommend a practice the importance of which, as applied to light soils, is so universally understood.

To have entered into the minutæ of the different operations required in a course of husbandry, such as is here recommended, or to have directed the specific modes of conducting them, &c. would have been repeating, and to no useful purpose, what is already known to every practical farmer, and, indeed, to every theoretical one. I have consequently avoided dwelling unnecessarily upon that, which it would have been superfluous to have written upon, and which could not fail of being tedious in the perusal.

It may not, however, be improper, before the subject is finally dismissed, to remark, that were the system here proposed to be acted upon, it would probably be necessary for the farmer to make some slight alteration in the arrangement of his stock. On this head no general rule can be laid down. Every one must adopt that arrangement which shall best suit his own particular case. In many cases, however, no alteration of any kind need to take place. Upon every grazing farm a certain portion of it is set apart for hay. While, therefore, the pasture was under tillage, the meadow might, and most probably would, be converted into pasture; clover, straw, and green food, making a reserve of hay unnecessary.

That system of agriculture, permit me to repeat, is the most perfect which obtains the greatest produce (as applied to raising articles of food) from a given quantity of ground at the least expense. And in no way can such produce be so effectually obtained as by a course of crops, furnishing sustenance to man and cattle alternately. In this course there is nothing of novelty or experiment; it has been known probably for ages;* and the practice of it has already been adopted, with the happiest effect, on many of the light lands in this kingdom, particularly in Norfolk, for more than half a century past. That it is equally practicable and

* Hartlib, who lived nearly two centuries ago, says, that in Normandy it was customary to feed the cattle in the winter on boiled turnips. The custom, however, is of much older date: Columella, who wrote in the time of Tiberius, mentions the giving turnips to cattle in the winter as a practice that prevailed amongst the Gauls even in his time. From the manner in which he relates the circumstance, there is reason to conclude the turnips underwent some culinary preparation. It is a curious circumstance that a practice, which is considered even at this day as a novel and refined improvement in husbandry, should have been familiarly known at so remote a period, and amongst so rude a people.

Columella speaks also of its being a common practice in some parts of Spain to grow corn, to stand for a crop, and to be mown green for fodder, alternately. Here is another modern improvement, at least as old as the Christian era! Lib. ii. cap. 10, et 11.

expedient on heavy soils it has been the business of this Essay to point out, and to prove.

Should the agitation of a question, evidently brought forward by the peculiar exigency of the times, lead to a more extended cultivation of corn, without lessening the production of animal food, the present scarcity may be considered as having laid the foundations of future plenty; and the public will have derived, in the event, a permanent blessing from a temporary evil.

No. X.

*It is required to "examine into the best Means of converting certain Portions of
"Grass Land into Tillage without exhausting the Soil; and of returning the
"same to Grass, after a certain Period, in an improved State, or at least
"without Injury." By Charles Goring, of Weston, near Steyning, Esq.*

FACILIS DESCENSUS (ARATRO.)
SED REVOCARE PEDEM!
HOC OPUS, HIC LABOR EST.

NEVER having made the experiment of converting grass land into tillage for the mere purpose of meliorating its condition, nor ever having had an idea that it could go through a succession of crops without injury, considering it as future pasture, I am the less prepared to give a full and satisfactory answer to the proposition which the Lord's Committee have submitted to the Board of Agriculture for examination; and the course of crops,* and time for their continuance proper for that purpose, I have never paid any attention to, for the reason above given. But as it is hoped that no person will be deterred from communicating his knowledge, though it be confined within narrower limits than those prescribed, and though his information be less important, I have presumed to address the Board, willing to give all the information I have derived from a long experience, with regard to the principal point in question, which seems to be, that of restoring lands to pasture after they have been in a course of tillage.

* In good pastures, where the object must be to gain some profitable crops of corn, there can be no difficulty in converting them to tillage, because they are fit to sow with either pease or oats at once ploughing. But if the design be to turn rough bad pastures to good grass, some feeding crops would be necessary; but if the object be grass, it would be attained better by manure without the plough.

It is to be lamented, however, as an unfortunate circumstance, that the nature of that proposition should be such as to prevent my fixed opinions from coinciding with what appears to be their Lordships' wish; for it seems to me to be wholly repugnant to reason, that grass land should be improved, or even left uninjured, by a succession of crops, every one of which must necessarily take something from it; whereas it has always been impressed upon my mind from my early infancy, that nothing but length of time could restore an old turf; and however laudable that spirit may be which excites an active mind to resist what appears to be a vulgar prejudice, yet I doubt not but it will be found upon trial, that the old sayings of our common people, which have been delivered down from father to son from time immemorial, are maxims which ought not to be disregarded. The weight they have had with me has been such, that I have once in my life collected turf from odd places where it could be spared, and covered a field of seven acres with it,* for old turf, from whence soever it may be taken in the same neighbourhood, will contain nearly the same sorts of grass, and though it may appear coarse, in that neglected state, to an incurious observer, will nevertheless, when placed in a proper situation and regularly fed, recover its natural verdure and sweetness.

Such being my predilection for old turf, I must of course think,† that, the less time the land is continued in tillage, the shallower it is ploughed, and the more feeding crops it has during its state of cultivation, the better may it be expected to be in its future state of pasture.

And it is not without a great degree of satisfaction that I observe the care which the Lords express for the old pasture, that it be not injured, looking upon it no doubt as a sort of sacred possession, not to be violated but with great caution in a case of necessity; for beef and mutton, butter and cheese, which are all best produced from old pastures, are as necessary articles in the food of man as bread itself. It has often too been suggested, that in many situations our land may be more advantageously cultivated with oxen than with horses—"Much increase is by the

* The expense of this, exclusive of my ox carts, which I could well spare in the winter season, I compute at about 40s. per acre; and I think it money not ill laid out, especially when I compare the field with others that have been seeded down.

† I should not suppose it to be of any great consequence what sorts of corn crops were taken from it, so the whole manure made from them should be returned to the land again, or an equal quantity. I mean wheat, oats, or barley, such only as make dung.

strength of the ox," says the book, (if it be not too unfashionable to quote it) which our nation in its infancy was taught to revere, but which in the wisdom of its old age it is but too prone to despise. Now if the ox is to plough the ground, he must be fed, and if he must be fed, he must have a certain portion of pasture land set apart for him, which must be better fenced and better watered than arable lands have any need to be; and as water and fences will not follow the plough about from one end of the farm to the other, so the pasture and arable must be separate, and each have its proper place assigned to it. The *alternæ vices*, which are so often playing upon the tongues of some theoretic farmers, must be confined to a succession of different sorts of corn, to fallow, to seeds and turnips (for more than this the poet never meant *), and the goose that lays her golden egg every day must not be cut up to gratify an idle curiosity, or risk a visionary experiment.

I do not even admit that grass land should be mown and fed alternately; it is certainly the way to go on the longer without manure, and as certainly the way to ruin (*pari passu*) both fields in the end. In order to maintain its proper quantity of stock (we used to say) the land must be used to it; the more it keeps, the more it will keep; four this year, five the next: give it a little manure, more stock will follow, and so on till it has attained its *ne plus ultra*, if that point be to be attained.

Land that has been used to the scythe will not (*ceteris paribus*) keep so much stock and so well as an old pasture, though it may have been better manured; neither will old pasture produce so much hay as the other; each will grow as it has been accustomed to grow; but the old pasture has an inherent sweetness in it, as well as virtue, which is hardly to be seen upon the ground, but is to be felt upon the rumps and sides of the ox; or to be discerned in the number of sheep which it maintains. But when it becomes a question, whether old grass pasture land is to be hurt by tillage, let any one who doubts it, take a spade and examine the top soil; he will in general find it to consist of a light, rich, black mould, two or three inches in thickness, under which the earth will be of a stiffer nature, and differing most probably from the first in colour; this the plough would necessarily turn up and mix with the upper stratum, and thereby deteriorate the whole mass, as when wine is mixed with water. After a few years tillage the soil would become harsh, stiff, and of a more untractable nature; the crops taken from it would have exhausted its prolific qualities, and rendered it less kind for the growth of grass; for upon now setting in the spade again we should discover no such light, black, rich mould

* *Alternis facilis labor.*

at the top as before, but the whole to the depth of the plough alike in substance and in colour.

Should we ask the gardener what he wants to renew the soil of his exhausted garden, for his flower beds and his trees, he will tell you there is nothing so good as the rotted turf of an old pasture.

At the beginning of a lease a farmer will sometimes manure his land at the expense of £ 8. or £ 10. an acre, and yet even this will not produce a continuance of crops like an old pasture; and hence we may learn that the permission to break up is worth more than tenants are willing to give (perhaps from inability), or than the penalties in leases require.

There are undoubtedly some rich pastures which have a greater depth of mould than what is above-mentioned, yet even in these I will venture to say the best will be found nearest the top, and that the plough cannot be introduced without danger.

In Romney Marsh there is a sort of land they call pil-rag, which is not estimated at more than half the value of the maiden-land, on account of its having been formerly in tillage. Far be it from me to say that such land cannot be restored to its pristine goodness, for the means of doing it are near at hand;* but I will say that it never is so restored by the tenant, nor is it likely it should be, and therefore must be set down as a loss of so much capital to the community.

But though such land might be restored, yet there is a great deal of cold, wet, stiff land, which is often good pasture, from having an old turf upon it which has been the growth perhaps of a century past, or more, to which the plough would prove utter destruction; yet I will not say that even this in some circumstances might not be restored; where there is a superabundance of manure any thing may be done, and without it nothing.

A friend of mine having an opportunity of getting a great quantity of manure from a neighbouring barrack, took an arable farm into hand, which was not far from the town, in order to lay it to grass, and has now for some years made it his business, as well as pleasure, to employ his carts in conveying those riches to his Sabine vale; yet I could not forbear exclaiming lately, upon going to see it, with less civility perhaps than truth, "What a small shew there is for your great exertions!" † forgetting most probably the original poverty of the land in the impression

* By sludge or salt mud.

† The soil, a loose sort of clay upon sand-stone, bordering on a forest, and poor. I make no doubt, however, but the land will be very much improved; but time is necessary as well as manure.

made by its present aspect. What quantity of manure, therefore, may be necessary to restore land after tillage to its wonted goodness, must in a great measure depend on the sort of soil on which it is to be expended. The more hungry the soil, the more it will require; but it will be difficult to give even the best too much; and give it what you will, time only can restore it to what it was in old pasture; it must have time to establish such a variety of different grasses into a matted turf, and time, with the frequent droppings from the cattle, to meliorate the surface into that light black mould, so necessary to cherish and thicken its growth.

Let the chymist try his skill, to form a compost like the mould of rotten turf; how many summer's suns and winter's frosts will be wanted to meliorate the mixture before it will be at all like the original? and when he has done, I should fear it would be, as the imitations of James's powder, alike only in the appearance, and when put to the test, fail of the effect.

The cases in which it may be eligible to drain lands for tillage, seems a question more easy to be answered, as I cannot conceive any one can doubt but that all arable land, which is at all springy, requires to be drained, at least I am very sure it will be the better for it; and I know no way so certain to discern where the land wants to be drained, as by observing it in a dry March, when the fallow lands will look white where they are dry, and retain their former colour and moisture where they want to be drained.

Paring and burning should be used sparingly, as it will only force a crop, and leave the land the worse for ever after, the best mould being consumed by it. In moory and sedgy lands, which cannot be made much worse than they are already, it may answer a very good purpose, and indeed the land may not be capable of being brought into tillage without it. Turnips, no doubt, must be the most proper crop to begin with, which hardly ever fail after it; but the tenant who has only a term in the land, will very naturally consider how to make the most of it during his stay, and will sow it with wheat, impatient of long delay. As to the depth which new land should be ploughed, which is designed to be laid down again to grass, I have given my sentiments already.

I should suppose there can be no way of feeding off crops so profitably as feeding them upon the land with sheep, where the land is dry and will admit of it; as the whole produce is returned to the land again without the drawback of any expense, except that of hurdles, which however, serve for other purposes also; and that no

one would carry off his crop to be fed elsewhere, except from the necessity of the case, where the land is too wet to admit sheep upon it. As it has not been the custom where I live to stack turnips for late feed in spring, I can say nothing to that management; but it strikes me, that nothing better can be had to succeed turnips than grass reserved from the preceding autumn, which will by this time, if the land be tolerably good, begin to flourish; but this must be understood of old pasture, and not such as has undergone those alternate experiments above-mentioned, which might look indeed as well to the eye perhaps, but which the sheep would return to in vain. When I say reserved from the preceding autumn, I mean what has grown in autumn, for I am clear in the opinion that all pasture should be fed very close in the spring, and not left, as the custom of some is, to remain for years, so that their cattle are starving in the midst of apparent plenty. What grows after Midsummer will always be eaten in the spring; and it seems to me to be the best of management to lay up in the days of plenty for the day of want.

As to the crop with which grass-seeds should be sown, the common opinion has always been, that they come on better in wheat than in any other crop, and the reason of this seems plain enough; for, 1st. The land is always better tilled for wheat than for any other crop; 2dly. It is better manured, and having been ploughed in autumn and mellowed by the frost of the winter, it is in better order to receive the fine seeds of the grasses, than land which is ploughed in the spring, and which cannot then be so finely pulverized by the tools of the husbandman, as the other has been by the elements of nature. Another reason may be, that wheat seldom stands so thick upon the ground as oats or barley, but leaves more room at the bottom for the circulation of the air, and the admission of the sun. But as wheat cannot be sown on wet land without ridge and furrow, which would be inconvenient for pasture, I should rather prefer sowing grass-seeds without any crop at all, especially as I am convinced that all corn crops are prejudicial to the growth of grass; and if you have your profit in that, this will fail you in a greater proportion, unless you can renew the land again by dung, &c.*

* The receipt is plain and simple. Clean the land; sow good seeds; and, as it falls to the lot of few farms to lie in the way of barracks for adventitious manure, save all the dung of the produce of the land which has been broken up, and mix it with mould. Spread it upon the new sown grass thinly, and repeat it from time to time, till the land has its own again. If you can give it more, it will be better.

If you destroy the grass even to the root, in an old pasture field, by the imposition of boards, flat stones, or faggots, &c. yet you will see upon its being liberated, it will soon regain its former gaiety and verdure; but it will not be the same with land which has been subjected to a course of crops.

A fine tilth I look upon as absolutely necessary for grass-seeds. The land should be prepared as for a turnip season, and the seed should be sown at the time the grass-seed fills; when we follow nature, we are most probably going right; if we delay longer to sow, there is danger that the young plants will not establish themselves so as to be secure against the frost of winter.

I once sowed grass-seeds amongst my turnips in the spring, and the sheep trod them in with their feet as they fed off the turnips; it was a dry time, and the ground light and dusty; and no corn was sown with them, and they flourished beyond any other.

As to the sorts of grass-seeds most eligible to be sown; it has always struck me, that as the thing wanted was a good meadow, so the seeds most proper to be sown should be the seeds of a good meadow, and the greater the variety of seeds the more eligible. There are many of them difficult to collect, and do not ripen at the same time, and therefore necessity may sometimes oblige us to use only those which are easy to be had, which are as follow; and which women and children will be glad to gather, at the prices under mentioned:

Soft broom (*bromus mollis*); sheep's fescue (*festuca ovina*); meadow fescue (*festuca pratensis*); darnel or rye-grass (*lolium perenne*); yellow oat (*avena flavescens*); sweet-scented vernal (*anthoxanthum odoratum*); meadow soft-grass (*bolcus lanatus*); fine bent (*agrestis capillaris*); white bent (*agrestis alba*); cock's foot (*ductilis glomerata*). These may be all collected together at 2s. the bushel in the chaff, from which they cannot be separated, but must be sown with it as collected. There is also another sort, which I would by no means omit, which is the crested dog's tail (*cynosurus cristatus*); that is, the common bent, of which our best pastures are full. It has a small fine seed, which is easily gathered by passing it hard through the hand. They get it at 6d. the quart. Manure will bring the white clover without sowing, and I believe a hardier sort than the Dutch,* as being an indigenous plant; but I do not observe that manure will bring up these

* I am tired of Dutch clover. It is pleasing to the eye, but makes no feed in winter, and dies away almost as soon as great clover. Bent and trefoil may be sown together.

blade-grasses so soon unless they are sown, and there can be no dependance for winter feed without them. The cock's foot and meadow soft-grass particularly furnish it; the former is the first to shoot up after the scythe, and its thickest tufts supply the sheep with many a good meal in time of snow. The common farmer, who has not been taught to distinguish between one grass and another, will call them both couch or knot-grass, and condemn them as a bad sort; but the sheep and the ox will contradict him, and they certainly must be allowed to be the best judges of what they like best. I have seen an instance of this with regard to the *bolcus lanatus*, which in a field newly laid down to pasture was sown upon a land, adjoining to another sown with rye-grass, and the former was eaten much closer than the latter. These grasses grow much faster than many others, and if the ground be laid free, will run up to be coarse and unpalatable to the cattle, and they will prefer the younger grass; but this is the fault of the grazier; why does he lay off his field till it is spoilt? The quantity sufficient to seed one acre may be two bushels of the blade-grasses altogether, a gallon of bent or crested dog's-tail, half a bushel of common rye-grass,* and a gallon of trefoil or non-such, which I rather prefer to Dutch clover, but this as every one may choose; yet though this quantity may do very well where the ground is in fine order, yet I think it would be better to add a little more of the *bolcus lanatus*, which is cheap, as it cannot be seeded too thick; and for this reason the crop should not be mown the first year, for that would prevent the seed dropping, besides, it would weaken it and make it thin at the bottom; but it should be fed rather sparingly along the spring, that the young plants may not be checked too much, and that some of it may run up to seed the ground afresh.

Whether the seeds should be provided by the landlord or tenant, must depend so much upon the agreement between them, that it is impossible to form an abstract opinion on this point, without knowing the particular case. But I have no idea myself of such a design being properly accomplished between two persons who must have such discordant interests in the thing. The tenant wants to get all he can out of the land; the landlord wants to reserve all the strength he can in it; the latter will wish the former to work, where he can expect no profit in return, at least no present profit, and his time is uncertain or transient at best; and the tenant will expect the landlord to deduct more rent than he can ever possibly hope to see made up to

* Whether the common rye-grass be the same as the *Lolium perenne* I have some doubts. The latter is always green in the pastures, the former seems wholly dried up in the middle of summer.

him by the projected improvement. After all, what inducement can there be to the tenant to lay the ground down to grass when by so doing he will make it less profitable to himself? or how can the seeds be expected to flourish when the sower must naturally wish them to perish that he may plough the land again? I have myself been twice deceived in this matter. I have twice let a lease of the same farm, in Romney Marsh, with covenants to oblige the two different tenants to lay down half the farm to pasture. When the time came, the land unfortunately was never in condition to be laid down, and it remained in tillage after both leases were expired. It may be asked, why did I not enforce the covenants of the lease? Because a Judge would tell me I should have no greater penalty than was proportioned to the damage sustained; and a Jury of farmers would say there was no damage at all; that the land was better in tillage. As to a Special Jury, Gentlemen frequently do not attend, and if they do, the expense of a law-suit, even with costs, might exceed what would be recovered.

I see no other way of laying ground to grass, but by the landlord's taking it into his own hands, which few care to do, unless it is near their home.

When once a tenant has got leave to plough old pasture, he will suck the orange, and throw the empty peel in his landlord's face. No bonds, no covenants will oblige him to lay it down in the manner it ought to be; and the manure, covenanted perhaps to be returned to it, will ride most heavily to a field from which he is to receive so disproportioned a return; what he has received from it already will be remembered no more. There is no debt so difficult to be collected to the full, as the debt of work.

The article of manure is of all the most material, it is the *sine quâ non*; and all your care in working the land or collecting seeds will be of little avail without it; the seeds may come up and flourish for a while, but after two or three years they generally go off. I do not say but that there is some sort of land so kind and so prone to grass (*quò injussa virescunt gramina*) that it may succeed with less care, and I shall mention an instance or two of it in my Appendix; but in most cases, one good covering of manure will be found very unequal and insufficient. If then there be such difficulty in renewing the face of the earth, when it has been once exhausted, surely it behoves us to be careful how we destroy that which we may not be able to restore, and to weigh well the opinions of our forefathers.

——— *patrios cultus habitusque locorum*

Prius ignotum quam scindimus æquor.

It is not easy to calculate what satisfaction the landlord should have for permission to break up old pasture, but the principle on which he should be remunerated seem to me to stand thus.

The virtue which is inherent in old pasture has been accumulating for ages, and has in it the nature of principal rather than interest. The owner who suffers it to be violated is breaking in upon his capital; every year lessens it something, till by the end of the lease it is wholly absorbed. Therefore he should have for such permission not an annual rent, but a valuable consideration,* as an outgoing tenant has from his successor for manure and other improvements left upon the land, which the landlord himself must pay if it fall into his own hands. It seems a sort of property which he has a right to sell like his timber, his fellable underwoods, or the furniture of his house.

To place this in another point of view; suppose a tenant, upon taking a lease, finds it convenient, for his cows or horses, to lay down a field to grass which has been usually ploughed; he will, towards the end of his lease, expect his landlord to pay him for it, if he wish it should be continued in pasture, otherwise he will plough it again for the remainder of his lease. Let us then place the landlord in the situation of the tenant; if he has laid down the land to grass, he must have the same right to break it up again, or to receive a price for permission to break it up; and if his ancestors have laid it down, he stands in their shoes, and inherits the same right from them, provided he has not been restrained by their wills. Was he to agree to receive an annual rent for it, he might lose it half in case his tenant should fail, for in the course of ten years, (half the term), we may suppose the virtue of the old pasture might be exhausted.

Such, Gentlemen, are the opinions of an individual respecting the conversion of old pasture into tillage, and returning it again to pasture, which would have slept within his own breast, if you had not called for them, and made that a duty which

* This business of valuing between the incomer and the outgoer seems to me to be very improperly conducted. Two farmers are appointed to value; the landlord is no party to it, nor knows any thing of the matter, till it happens that he wants to take the land into his own hands; then he finds that it is their custom to take more out of the land than they have any right to. The incoming tenant does not regard it, because he is to be paid again when he goes out. If there be a wide hedge-row on one side of a field and none on the other, they will sell where there is an overplus, and not leave any to make up the deficiency. I have myself paid, exclusive of all dung and workmanship, 30s. an acre, for which I received only 13s.

otherwise would have been presumption. The experiments, on which these opinions are confirmed, are set forth in the Appendix.

But as the object of the Committee seems to have been to discover the best means of obviating the continuance of the present scarcity, if he might presume to surpass the limits they have prescribed, he would be induced to add, that the Committee have judged wisely in concluding that the only immediate supply to be relied upon must come from our best lands; for, however, the cultivation of wastes might be useful to posterity, it would not apply so speedy a remedy to our necessities as the time requires. The neglect of our wastes has been indeed unpardonable. When we look back to the history of times past, and read that famine has at several intervals stalked through our land, she might naturally have been expected to do the same again; and there was a time, I well remember, a happy time of peace and plenty, when enriched with the spoils of war, every one was eager to turn his sword into a plough-share; and had these wastes been at that time allotted to every man his portion,* we might never, perhaps, have known what it was to be weighing out our bread to our children, and supplying its place at our own left hands with a potatoe. But the cultivation of wastes is unprofitable at the outset, and in the present day might tend more to consume the fruits of the earth than to increase them, and this in an increased ratio, as the inclosure became more general.

At present then let us turn from the wide barren waste to the more fertile fields which are already inclosed; which seem to cry to the ploughman, come here, and we will laugh and sing! I mean the large farms of upland pasture in dry healthy situations, where people might be made to spring up as mushrooms, (an honest race of men, to celebrate their annual harvest home, to honour and defend their king, and to sing praises to their God), not by throwing stones over the head like Deucalion and Pyrrha, but by holding out to them the staff of life; for inhabitants will always increase according to the means of their support. But now how dreary is the scene! The reaper here filleth not his hand, neither he that bindeth up the sheaves his bosom. The ants and moles live in undisturbed possession, as if the property had no owner, or was in the hands of an infant, or a lunatic, or in a state

* I mean with the blessing of God. But he sometimes chastens those he favours, and maketh a fruitful land barren for the wickedness of them that dwell therein. May old England be wise enough to see this! and fear Him, who removeth the whole stay of bread and water at his will, but whose mercy is over all his works!

of litigation, producing neither men, nor the sinews of war for the use of the country. Let me not be mistaken; I do not mean that these good pastures should be wholly converted into tillage; they have their merit; but every man who understands farming knows, that if a fourth, or perhaps a third, part of these farms were ploughed, they still would maintain through the year as many cattle as they do at present, and perhaps, with good management, more. The ant-hills would soon be burnt to ashes, and the labourers, necessary to the plough, would at odd times turn their hands to the mattock, the scythe, and the draining spade. It may be asked, how will you enforce tillage against the will of the owner? I agree, in a general view, compulsion and restraint do more harm than good in agriculture as well as in commerce, yet there could be no great hardship in obliging every district (great and populous towns out of the question) to furnish corn enough of its own growth for its own inhabitants; I mean every district which is proper for cultivation; and when the plough should be once introduced, the advantage of it would soon be felt, and most probably be extended. The premium, given by the tenant to break up, would build barns and cottages, and the rent might also be increased. In times like the present, it behoves us all to supply each others wants, and contribute all we can to the public stock, and the support of the state, according to our respective abilities, and the means which God has given us of improving our talent; but the proportion which these men contribute is light upon the balance; they have the most ample means; they are deficient in industry:

—juvat arva videre,
Non rastris hominum, non ulli obnoxia curæ.

APPENDIX to MR. GORING'S ESSAY.

THE lands, which are the subject of the foregoing Essay, must be understood to be such as are worth from 20s. an acre, and upwards; as to those of inferior value there certainly is a less risk of damage, if there is not a better prospect of improvement by tillage. But as the Committee require particular attention to be paid to clay, loam, sand, chalk, downs, and land too wet and strong for turnips, and as I have all these soils within the boundary of my farm, I think it necessary to state the result of the trials I have made in converting them from tillage to pasture, and some few of them, such as had been broken up not many years before, which come nearer to the point in question.

I commenced farmer in the year 1769, and have since that time laid down about 300 acres to pasture intended to be permanently so, but many of them have been again broken up and returned to the plough, on account of their not answering the end designed, for want of manure.

My first attempt, which was made in two or three years after I began, * was upon a sandy hill (value about 10s. or 12s. an acre) which lay within sight of my windows, and used to bear pretty good turnips and barley. It was laid down in good condition with rye-grass and Dutch clover. It looked well for two years, and then failed very much. I carried mould and mud upon it, and such as I could spare from my other land, which, though it had a good effect, yet fell short of my expectation. It burned up very much in summer, and in many parts had little else than mouse-ear, and the ground appeared through the turf all over the field for years. It was a dry sound piece of ground for my sheep, and lying before my windows, I did not care to plough it again. It now at length improves very fast: having got some other land adjoining to it which I sow with turnips, I have for the three or four last years let the sheep out upon this pasture to hay, when they have been feeding the turnips, which has made a great alteration in it; so that a surveyor,

* How long this had been broken up I do not know, but it was then fresh in the memory of the workmen, who talked of its having been over-run with bushes and rabbit burrows.

who lately came from another county to value the tithe, esteemed it to be worth 25s. an acre, which has confirmed me in the opinion, that such men are only wise in their own country.

The next attempt I made was upon about forty acres of clay land (unfit for turnips) of about 12s. annual value. I took this for my sheep in the spring; it was not exactly what I wanted, but I could then get no other. This, I think, was laid down with rye-grass, and Dutch clover, and hay-seeds, which came up very well and flourished as before for two years, and then began to go back, though never mown. I could not conveniently give it any manure, and I believe it would have required half a century to have brought it to a good turf without. After five or six years a more convenient farm was offered to sale; upon which I let the other to the adjoining tenant, who agreed to give me 40s. an acre premium for breaking up, which shews it to have been laid down in clean and good condition. The new farm had 60 or 70 acres of good corn land, of a dry, black, loamy mould, lying under the South Downs. Here it was I sowed the seeds in the turnips. The whole was laid to grass, being sown with the seeds mentioned in the Essay, which flourished well at first, but at the usual time began to flag, and no manure being at hand, I began to despair of my pasture, when two other farms were offered to sale adjoining to my own; whereupon I let this, receiving 50s. an acre for breaking up. One of the new farms consisted partly of the above mentioned black rich land, and partly of wet cold clay * with very little mould upon it. About 18 acres of the former sort were laid down with the grass-seeds above mentioned, which flourished awhile, but afterwards fell away as before. They were then folded upon, which had a great effect at first, which has, however, since ceased, and they are become mossy, except where a little stream of water has been introduced from the yard, which takes great effect; but even here the land does not look like the old pasture which is fed with it, the fence having been removed. It has been down in grass about eight years. There were also laid down about 35 acres of the wet cold clay land, part of which was fallowed and laid down as above, and having been twice dressed with lime and mould, looks pretty well; (valued by the surveyor too at

* About three acres of this land were sown with tares in order to feed them off altogether; but, it being a wet summer, there was no opportunity, and they were mown for hay. They are now covered almost with couch-grass, but as it is not very convenient to plough it, I think of trying what a good coat of manure will do.

25s.;*) another part which has had some dressing of lime and mould, but not so much, looks very badly; and a third part which is let to a publican, who has given it an extraordinary good coat of dung, looks very flourishing indeed. The other farm was of a sandy nature, and here I covered the field with turf; the land was very foul; it was ploughed once, and harrowed fine, and then the turf was laid upon it, which kept every thing under. Here was a field of 12 acres which had been broken up about six or seven years; this was fallowed and sown with the above grass-seeds at Midsummer, which grew very well at first, but went off as before; and for want of some adventitious manure, which is not easy to be had, it is not half so good as the adjoining meadow, which it much surpassed before it was ploughed at all.

But during all this time, I have not been confined to works at home. Owing to a drunken tenant, to whom I had given leave, in the days of my folly, to break up about 50 acres of excellent grass land, and who failed in a few years after, a very considerable farm, † at a few miles distance, fell into hand, and I was so provoked at the usage I received, as well as at the condition of the land, that I determined to lay down about 100 acres of it to grass. Accordingly I went to work, and sowed the seeds about Midsummer as before; 36 of the 50 acres above mentioned, which had been ploughed only six or seven years, came on very well, and seem now to be as good as ever they were; but the other 14 being of a stiffer nature and nearer the clay have not done so well, nor has the rest of the land in general, though it is now very valuable grass land. But I must observe, that there are 12 acres adjoining to the 36 of the same yellow gravelly soil, which were in a clover ley when I took them, and which had nothing done to them, except a little manuring, which came on just as well, and are now, I believe, just as good as the 36 acres. This farm has been let in grass at an advanced rent sufficient to pay me for my trouble. I next took in hand another farm, where I laid down about 50 acres for the convenience of a town, in the same manner as before. About 15 acres of it were of that gravelly sort above mentioned, which answered very well, but

* A surveyor, who values tithe, should take care how he proves too much. Who will continue to pay corn-tithe, if they can make such ordinary land so valuable in pasture so easily?

† This was about 17 or 18 years ago. Part of the farm is of a fine rich hazel mould upon a sand; the part, where the 36 acres are, is gravelly upon a loamy rocky substance. There is a sufficient quantity of arable still left.

there was some wet and stiff land which would not have answered at all, had it not been for the quantity of manure which the tenants brought upon it, which will in due time effect the purpose.

Lastly, I have permitted a tenant to break up about 60 acres of Down, which was over-run with juniper, &c.; the soil is in some places black, in some reddish, full of large flints, with an under stratum of chalk. He sowed,

1. Rape and turnip,
2. Oats,
3. Seeds,
4. Oats,
5. Rape and turnips,
6. Oats, seeds,

in which it now is, and looks very well, and thick; and I believe if it was not ploughed again it would be better pasture, and worth more than it was before it was broken up, which was but little. The expense of ploughing and picking off the stones has been great, the crops but moderate, and not such as to pay very well for what has been done, unless it were ploughed again. But as to chalky hills* that are broken up, they will not recover themselves for an age, without some extraordinary manure, and who can afford to give it them? But I speak this of a hard barren sort of chalk; where there is chalk marle, or free chalk, the case is different; but this generally lies deeper under a gravel, and not upon the surface.

A friend of mine, who, had he been now alive, could have given much useful information on this subject to the Board, had, like myself, a drunken tenant, who failed, and the land lying round his house, he took it in hand, and laid it to grass. It is as good land as any in the kingdom; the soil is a rich, black mould, intermixed with yellow gravel, a little elevated above the marshes of a tide-river. The seeds flourished at first, but went off as before-mentioned, after two or three years. Having salt mud or sludge near at hand, which he laid on plentifully, he soon recovered it. There was a separate field, which was esteemed inferior for corn, lying rather upon a lower level, yet above the marshes, which might be of a moister nature, though the soil seemed pretty much the same as the other. This field was a wheat stubble, and he left it as it was, sowing only a few hay-seeds† in it, for it was not convenient to him to fallow it, and to our great surprise, this field came to

* We see many instances of this.

† The seeds were sown without corn.

a turf sooner than the other, upon which he had bestowed all his pains. These are the only two instances I have known of grass coming again to perfection in a short time without extraordinary manure, and which I impute solely to the quality of the soil.

Farmers, I know very well, will tell you that you may take off three or four crops from grass land, without hurting it; but their meaning I suppose to be this, that it will suit their purpose very well to take off three or four crops, and whether it comes to good grass or not afterwards, is very little concern of theirs. They know that by the time it has had three or four crops, the land will be foul and not fit to lay down, and then they can petition for a longer term.

A tenant of mine, under covenant to lay down a portion of land to grass, laid it down in high ridge and furrow, and then wanted to plough it up again, pleading this ridge and furrow as a great inconvenience.

It seems less difficult to discover the best method of returning arable land to pasture, than to enforce the practice of it. Should a general licence be given to break up old pastures, the crops would be taken off, and the return of the dung would be forgotten. The injury to the public would be great, and almost irreparable. No particular mode of ploughing, or choice of corn-crops, however judicious, could make amends to the ground for the loss of its manure, and it would be in vain to expect from any superficial contrivances of art that success, and those solid advantages, which fall to the share only of unremitting labour, and unwearied assiduity. The earth is a kind mother if she be liberally treated; but seldom suffers herself to be cheated of her just dues with impunity.

Jan. 11, 1801.

No. XI.

An Essay on the best Means of converting certain Portions of Grass Land into Tillage, without exhausting the Soil; and of returning the same to Grass, after a certain Period, in an improved State. By Dr. Campbell, of Lancaster.

ARIDA TANTUM
NE SATURARE FIMO PINGUI PUDEAT SOLA—

GEOR. LII. 1. 80.

THE person who submits the following Essay to the consideration of so respectable a Body as the Board of Agriculture, was induced to do it, partly from his having been for some time past indirectly, and the last three years practically, engaged in the pursuits to which the inquiries of the Board are directed, and still more, by the indulgent invitation held out in their Address.

In throwing these observations together, he has been solicitous to banish from his mind, as much as possible, what he has heard or read upon the subjects referred to; and to confine himself to the stating of that only, which has been the result of actual experiment: in doing this, it will be impossible to avoid treading in the footsteps of those who have gone over the same ground. Of such, and of those whose means of information have been more enlarged than his own, he has to request the indulgence. The principal points he has been engaged to establish, are, the necessity of duly cleaning and pulverizing the land; the advantages of plentifully manuring that which is under cultivation and tillage; and the utility of restoring it to the state of grass before the strength the manure is exhausted. The indolent or the niggardly cultivator, who expects to reap good crops without labour or expense, will not here find the information suited to his purpose.

An apology is deemed highly necessary for many defects in the following pages. Some excuse may be hoped, from the shortness of the time since the Address from the Board was noticed; and from the many avocations of the writer, which have prevented him from transcribing the whole, and arranging some of the parts in the manner he could have wished, so as to have met the eye in a less exceptionable form.

THE object of the following experiments was to discover the shortest, or the most profitable manner of converting a small farm into good grass land; it being taken for granted, that the soil which is made capable of producing an abundant crop of nutritious grass, may at any time be converted into fertile arable land.

The farm in question is situated in a lime-stone country; and the soil is what is there known by the denomination of hazel mould, or light loams. It comes nearest to what Mr. Kirwan, in his *Treatise on Manures*, calls sandy loam, but is different from what is really such, and which occurs in those districts, where grit or sand-stone forms the basis of the substrata; inasmuch as a very small portion of silicious sand enters the composition of this, whilst there is a great abundance of it in the other. Soil of this sort, and which generally occurs in those districts where lime-stone and blue rock (*schistus*) constitute the basis of the country, appears to be formed almost entirely from the accumulation and decomposition of vegetable matter, and may have been rightly called vegetable mould.

The immediate substratum is, in some places, the solid rock; in others, what in this country is called *sammel*, which is an aggregate of fragments of stone, (mostly lime-stone,) of all sizes, but in general small; these are not rounded but angular, and when the larger are separated, the mass may be wrought up into what those who are conversant in forming canals call puddle, which is capable of perfectly retaining water, and forms a tight bottom for ponds. In its natural state, however, it allows water to percolate easily through it, though not so readily as another substratum that also occurs, which is a loose gravel, the stones of which it is composed being universally rounded; the larger bedded with smaller and sand, and generally of a hard blue kind, (whinstone,) although there be no rock of the species within many miles. These different substrata have an influence on the incumbent soil, it being generally deeper, more loamy and fertile over the *sammel* than the gravel.

This kind of soil is easily wrought by the plough, and divisible into a fine tilth with much less labour than the stronger soils, which contain a greater proportion of the argillaceous principle. But it will not, without the addition of some of the stimulating or nutritious manures, produce crops that will repay the expense of

cultivation. Under no advantages of this kind is it, perhaps, capable of producing the weighty crops which occur in the soils that are of a stronger loam, and have a more considerable portion of clay in their composition. It has, however, an advantage, in not being so much affected by the extremes of wet or drought as these are. During the wet summer of 1799, when the turnips and potatoes (particularly the latter) were much injured by the water stagnating about their roots, the crops here did not suffer from this cause. The same may be said with respect to the last summer; for whilst from the long-continued drought, the stiffer clay land became so hard and baked (as it were) round the roots of the potatoes, as in a great measure to prevent their due expansion and growth, they experienced little comparative injury here, the crop having been sufficiently abundant; yielding, in my own case, a return of at least 27 times the seed planted.

It has also another advantage, that it is not subject to be injured by the feet of cattle, (or what is generally termed poaching,) which, by sinking into the ground, form, in clay lands, a receptacle for water, which rots the roots of the adjacent grass. The feet of cattle seldom sink into this ground; and water never remains in any hollow formed by the furrows.

As a leading defect in the heavy clay lands which are in a state of bad cultivation, is the production of rushes, so land in the same situation, in this district, becomes covered with moss, which prevents in a great measure the production of grass, or any other useful vegetable.

The farm, on which the following experiments were tried, consists of about 90 statute acres, of which about seven are moss, producing turf or peat, (in common,) but which may be made capable of carrying other crops; and three, coppice wood: the remainder is of the soil described above. It had been let on a term of seven years, which expired at Candlemas, 1798, for £64. *per annum*, the landlord paying the taxes, which amounted to about £6. annually. On entering into possession, the state was nearly as follows. About 16 acres, being tithe-free, had been constantly under the plough, and having had no green crops intermixed, these fields were overgrown with weeds, particularly the sow thistle (*sonchus arvensis*,) and couch-grass. The other parts of the land were in grass, for pasture and mowing; but having been, according to the custom of the country, exhausted by repeated crops of corn previous to their being abandoned to nature, and no top-dressings given, (all the dung of the farm going to the tithe-free land,) the produce was of

as inferior a quality as it was scanty in quantity. The grass, which in this country springs up spontaneously in land of this description, is soon attended with moss, which renders the sward of little value.

I shall now proceed to arrange the several experiments, in the order in which they naturally occur; beginning with the shortest, and so on to the longer rotation, of the crops.

No. I. A part of a field of old ley, grown over with moss, was ploughed about six inches deep, cross-ploughed, twice harrowed, and manured with stable dung, at the rate of about ten tons to the statute acre, and sown with white clover (*trifolium repens*,) ray-grass (*lolium perenne*,) and rib-grass (*plantago lanceolata*,) then rolled. As it was only broken up and sown the last summer, the result cannot as yet be ascertained.

No. II. A field of the same description as the above had received repeated top-dressings of dung, and lime mixed with mould, which had meliorated its condition; but as in a certain number of years, this land becomes more or less mossed over, which, as it were, choaks the useful grasses, and also is rendered coarse by hard knots (*centaurea nigra*,) rag-wort (*senecio Jacobæa*,) and similar plants springing up, it seems absolutely necessary that it should occasionally be broken up, for the purpose of getting rid of these intruders.

This field was ploughed, and a crop of oats taken. The second year, it was twice ploughed, harrowed, and after being manured as No. I. was sown with white clover, yellow clover or trefoil (*medicago lupulina*,) and hay-seeds, of the natural grasses of the country.

From the circumstance of no fallow intervening, the quantity of weeds, particularly charlock (*sinapis arvensis*,) which sprang up along with the seeds sown, was very great. It seemed to be a question, whether these did not exhaust the land almost as much as a crop of barley would have done. Towards the latter end of the year, the sown grasses appeared to have maintained their ground. This summer, which is the second from sowing the grass-seeds, the herbage has been luxuriant in the extreme, particularly of the trefoil, which will, however, like red clover, gradually fail, and entirely disappear in the course of two or three years. It has been pastured, and carried at least double the stock that it did before it was ploughed; and has at present (January, 1801) the appearance of a fine verdure, and great fertility.

No. III. The old ley, in this instance, was much worse than in the former, as no top-dressing of any sort had been given, after it had been exhausted by ploughing, and left to nature. It had been pastured for some years.

On breaking it up, (1798,) a part was sown with an early kind of oats, called here *duns*; and the other part with a later kind, called *old English*; in the usual proportion of seven Winchester bushels and a half to a customary acre, containing 7840 yards, or about five bushels to a statute acre.

There was a very manifest difference in the crops on the different parts of the field. The early kind, or *duns*, were short and thin on the ground, not yielding a return of more than four for one of the seed sown; whilst the *old English*, or late sort, gave at least six for one, with a luxuriance of straw in a much greater proportion.

It appears clear from the above, that although the forward oats are well suited to land that is in good condition, the later kinds produce a better crop on land that is poorer, and in a worse state of cultivation.

The second year, this field was ploughed, cross-ploughed, severely harrowed, as well to break the soil as to get out the root of the various weeds, and manured with a mixture of stable-dung, and lime with earth previously mixed, by being laid in alternate layers, until the lime was slacked, or converted into flour, then turned twice, so that the earth and lime were perfectly incorporated. The quantity of dung used was about 14 tons to the statute acre; and that of the compost of lime and mould, about as much. It was then sown with barley, in the proportion of three Winchester bushels to a statute acre; of white clover, 16 lbs.; trefoil, 4 lbs.; rib-grass, 4 lbs.; and ray-grass, 1 Winchester bushel and a quarter, and rolled.

It was observable, that notwithstanding so much pains were bestowed in reducing this field to a fine tilth, that the old sward could not, in many instances, be sufficiently broken, but lay here and there on the surface, like large pieces of a cable. This would have been, in a great measure, effected by another crop of oats, (had the land been in a condition to have carried it,) or still more effectually by the fallow produced by a crop of turnips or potatoes.

The crop of barley was luxuriant in the extreme, but the wet summer of 1799 occasioned a great part of the crop to be laid, by which means a considerable portion of the grasses sown was destroyed; notwithstanding which, and the excessively dry summer following, ten statute acres carried four horses and four cows the

summer through. The horses were the horses of the farm, which, although worked hard, kept themselves in good condition. This field (January, 1801) has the appearance that it will be completely covered with a fine sward the ensuing spring, and I expect it will carry a third more stock than it did the last year.

Upon comparing it with No. II. (the adjoining field, from which no crop of barley was taken upon laying it down with grass-seeds,) it appears to have in every respect as good a sward, and the verdure equally fresh.

No. IV. had been some years in a course of tillage. After being ploughed and harrowed, it was cropped with barley, and sown with the same quantity of grass-seeds as No. III. and rolled.

This field was mown the year after the laying it down in grass, which was not the effect of choice, but necessity; and upon comparing it with No. III. (which was pastured the first year,) or with No. V. it appears, that it would have been more advantageous either to have pastured it for the first year or two, in order to thicken the sward, or to have mixed red clover with the ray-grass, to produce a more abundant crop of hay, of the first year's growth.

To compensate for taking an immediate crop of hay, and to thicken the sward, it received the following top-dressing: 1st. On one part rotten dung, about 8 tons to the statute acre. 2d. On another part woollen rags, chopped, at the rate of 100 stones to the acre. 3d. A rich marle, in the proportion of about 80 tons to the statute acre.

It is now two years since these have been laid upon the field. On comparing their effects, the dung has produced the greater luxuriance. The woollen rags have a superiour verdure, a deeper green; but as they have not as yet been properly incorporated with the land, by the grass growing over them, their ultimate produce is not ascertained. The same may be said of the marle, which having covered the ground, into which it is not as yet carried down by the rains, and the grass not having grown through, it has as yet rather done harm than good.

The character given of the properties of woollen rags, as a manure, induced me to give them a trial; and as they came in at about 7d. the stone, and will bear carriage from a considerable distance, an acre can be manured by this means for about £3. effectually, should they be found to answer the purpose.

There is no marle within a considerable distance; what was here made use of was brought by means of a canal, and costs at the ground 2s. the ton, a price at

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which it can only be made use of as a top-dressing. The known fertilizing qualities of this mineral, and its great durability, joined to the idea, that the soil in question was deficient in the two properties of calcareous and argillaceous matter, which the marl would supply, induced me to cover about three statute acres with it. As marl is one of those manures, whose operation is slow, and whose return cannot be expected in a shorter period than two or three years, it is necessary to wait the due time before the result can be determined.

REMARKS.

Land, which is covered with a coat of moss, will be amended, merely by paring the surface, and turning the moss underneath. This change will take place in a much greater degree, if lime be, in any way, mixed with the soil; and in a still greater, if the soil be ploughed to a proper depth, worked into a fine tilth, and blended with dung; it will then not only be capable of producing an increased quantity of grass, but other valuable crops in due succession; which will lead it back again to a state of grass, in an improved state, in which it may either remain for an indefinite number of years, or be again broken up in a course of tillage, as may suit the views of the cultivator. It was to ascertain which was the most eligible method of effecting these purposes, that the different courses here enumerated, have been tried.

Different modes of proceeding will be adopted, according as the views of the cultivator are directed to a more or less speedy return into grass, of the lands he intends to break up; and to the means he has of procuring manure.

If he possesses no other manure (*e.g.*) than lime, his views must be limited to the simple re-conversion of it into grass, or, at most, after taking a single crop of oats; otherwise he will fail in his object of amendment. Where he has also a command of dung, he may extend the rotation of his crops in various ways, previous to his again returning the land to grass.

One of the shortest methods of effecting the conversion of indifferent pasture into good grass land, appears to be that stated in No. I. But as the object of the cultivator, and especially the farmer, is a speedy return of profit for his labour, this will scarcely be practised, except under particular circumstances; because there is the loss of a valuable crop, which would immediately repay a considerable part of

the expenditure. For instance, had a crop of oats been taken from No. I. or a crop of barley from No. II. these might have been worth from £6. to £10. per acre, which the cultivator comes into immediate possession of. But it will be a long time before these fields can, by the excess of their produce over No. III. (from which a crop of barley was taken the year it was sown with grass-seeds) compensate for this loss incurred in the outset. Still less shall we be inclined to pursue this plan, if we perceive so little difference betwixt the state of vegetation in the fields, No. II. and No. III. at the end of the second year..

Grass-seeds.—In this country there is a great prejudice in favour of what are called natural grasses, or such as spring up spontaneously, in opposition to a particular one, which has been selected. in preference to many others; I mean the ray-grass, (*Iolium perenne*). It is impossible for any things, called by the same names, to be more opposite, than the natural grasses, in fields under different states of cultivation, or in different soils. In many, I may say in most cases, they are an assemblage of the refuse of vegetation. I have seen a field of this natural grass, which consisted almost entirely of a mass of couch-grass; another, almost as entirely of cock's-rattle, and hawk's-weed.

It is also true, that different grasses are natural to the same soil, in different states of cultivation. For instance; if land be in good condition, and has been well cleaned from weeds, at the laying it into grass, it will, in a certain time, be covered with the more valuable grasses, such as the poas, meadow fescue grass, ray-grass, soft meadow-grass, oat-grass, and the like. If this land be exhausted, by taking repeated crops of hay, without the necessary top-dressings to recruit it, the luxuriance of these grasses will fail, they will dwindle away, and, finally, in a great measure, disappear; they will then be superseded by moss, cock's-rattle, hawk's-weed, wild carrot, &c. five cart loads of which will not be equal in nutriment to one of the former.

Ray-grass.—It being in contemplation to sow this grass, it was found that the uniform opinion of the country was against it. There was none sown within thirty miles or more. One person said, it was a hungry grass; others, that it was a coarse grass; another, that it impoverished the land, &c.; but, as their opinions did not arise from fact, or actual observation, it was determined to put the matter to the test of experiment, and the field, No. IV. was sown with it, (principally,) in conjunction with white clover, and a little trefoil. The result has been perfectly

satisfactory, and entirely coincident with what is mentioned respecting this excellent grass, in the *Memoirs of the Bath Agricultural Society*. No hay could be better relished by my horses than this was; not a particle of it was wasted by them, or left in the rack; no animals could thrive, coat, or do their work better, than they did, whilst they had this ray-grass hay to take to. Never was there a greater contrast, than when they were put to the natural hay-grass of the country, after they had finished the other. They were literally starved into the eating it, and, in spite of an additional quantity of corn, they fell away, (agreeable to my farming man's mode of expression) a limb a-piece. This year, nothing can look better than my horses do, upon this hay, (with which some red clover is mixed,) and this, with the addition of very little corn, and that mostly light, the tailings of oats and barley.

Upon looking back at the different opinions that have been given of this grass, it is conceived that they may be naturally accounted for. It has been tried in some situations, and found not to give a thick, well-connected sward. Ray-grass is natural only to good soils, or those in a fertile state; for, however it may be found accidentally in those of a contrary description, it will be only where the land has been enriched by dung, or other manure, casually dropped. It comes up spontaneously, for the most part, by the road sides, or near the gate of a pasture field, where the cattle are accustomed to wait. The present summer, a field was observed to be so full of ray-grass, that, knowing none had been sown in the country, it became a question of curiosity, to discover what circumstances had occasioned it. Upon inquiry, it turned out, that a large quantity of cattle, for a neighbouring fair, had been folded there a night, who had covered the field with their dung; whence the tendency to produce ray-grass.

When land is in a proper state of manure, ray-grass, united with white clover, will form a perfect sward, the latter end of the second year, after it is sown. I have a particular field, of about five acres, that was sown with these two grasses only, that is more perfectly grassed over than others, which had the addition of trefoil and rib-grass, and which were sown at the same time.

A neighbour of mine, the only man in the country that had tried ray-grass, told me it would not answer, and referred me to a particular field, where some had been sown. The fact was, that he had cropped this field with oats, until it was no longer worth ploughing; and then, with his last seed, he sowed ray-grass,

which, certainly, did not flourish. But his argument would have been equally conclusive against any grass, or grain, whatever. The ray-grass languished, and, finally, died away, giving place to the vegetation suited to the state of the land. If it be expected that ray-grass, or any other good grass, should thrive, and produce abundant crops, on exhausted or poor land, it must not be in the soil which occurs here.

On converting ray-grass into hay, it is necessary to cut it at a period previous to its being so ripe, as to have perfected its seed, and changed to a yellow colour; for, in this case, a great part of the juices of the plant, which constitute a principal part of the nutriment it is to afford, will be converted into a species of straw, and its nutritive properties be proportionably diminished.

When it is made into hay, persons not acquainted with its qualities, are apt to object to its aparent coarseness, which proceeds from its consisting almost entirely of flowering stems, the ray-grass having a comparatively smaller proportion of leaves than any other grass. Whether this be a defect, or a merit, will depend upon a solution of this question: Do the stems and flowering parts of grass, or the leaves, taken weight for weight, contain the greater proportion of nutriment? It does not appear that this has been determined by experiments, instituted for the purpose: but it seems probable, from the stems being so much sweeter than the leaves, (which is particularly perceptible upon chewing them, when about half dry,) and from those vegetables, which contain much saccharine matter, being particularly nutritious, that the greater proportionate quantity of nutriment will be found to reside in the stalks; and if so, the advantages of ray-grass will be decisive.

But, however this may be, it is certain, that, supposing wet weather comes on during the process of hay-making, the first part of the grass that decays is the leaf, which soon becomes yellow, and then black, losing all pretensions to nutritive properties; in which case, it is evident that almost the whole nutriment contained in the hay, must reside, exclusively, in the flowering stalks. Ray-grass then, has, in unfavourable hay seasons, an advantage over all others, inasmuch, as from having fewer leaves, it is not so apt to be injured by a continuance of rain: and it is, besides, when in the cocks, more accessible to the air and wind, from lying more open and light; and, consequently, not so apt to heat and mould as other grasses in similar situations and seasons.

It certainly possesses the following valuable properties: 1. That there are few

grasses so early in the spring. 2. That there are none better relished by cattle, nor more nutritive. 3. That it has the power of resisting the effects of bad weather, in ticklish hay seasons, in a greater degree than other grasses. 4. That there is a greater facility in collecting its seed, than of any other grass.

The prejudices against it appear to have arisen, 1. From its having been sown in land not capable of producing a full crop of any good vegetable. 2. From allowing it to shoot up so far, as to have formed the seed, in the flowering stalk, before cattle have been turned into pasture, or that it has been cut for hay. Ray-grass appears to partake more of the nature of grain than any other grass. Hence, when it has perfected its seeds, it shoots out no more stalks, and but few leaves, that season, as Lord Kaimes has justly observed. Hence it is necessary to turn cattle into a field of this grass, early in the spring, and to keep it well under, by a sufficient quantity of stock; in which case it will continue to put out fresh flowering stalks and leaves, during the whole season. 3. The hay, for the reasons just assigned, should be cut before it becomes a mere straw. Common hay-grass, being composed of grasses in various stages of growth and ripeness, admits of a greater latitude than a field of ray-grass, because many of them will, generally, be in a proper state for cutting, although others may have passed their prime.

Trefoil (called also *non-such*, *yellow clover*, &c.)—It is of much importance to the farmer, and equally satisfactory to every cultivator, to have the land he lays down for pasture produce an ample crop the first year. There are some grasses, or plants, which require two or three years to establish themselves, and acquire their perfect growth; whilst there are others, which acquire their extreme growth and expansion the first year after they are sown; of this kind are red clover and trefoil. Hence the advantage of mixing these with other sown grasses. I think the quantity of four pounds of trefoil seed to the acre is too small; and shall, in future, either double it, or add as much red clover seed, which may be better. In this quantity, they will not injure the other grass-seeds sown at the same time, but will furnish a copious vegetation, until the others come to perfection, at which period, both the trefoil and red clover have a natural tendency to disappear.

Rib-grass—seems a good plant for thickening the bottom of the grass. Cattle are said to have a dislike to it, in some treatises that have fallen into my hands. Certainly the flowering stems are here eagerly eaten by all sorts of stock. It is early in flower, and flourishes particularly in moss lands that have been drained.

We now proceed to a course of tillage, in which a greater variety of crops is successively introduced, previous to the land being returned to the state of grass.

No. V. (1798).—A field of about four statute acres, which had been in tillage for some years, and which was over-run with weeds, particularly couch-grass, and swine-weed, was ploughed, cross ploughed, and harrowed severely, to get out as much of the roots of the weeds as possible. By these means it was wrought into a pretty fine tilth, and prepared for a potatoe crop.

The potatoes were set in drills, * the furrows about two feet asunder; this admits the horse that brings the dung on the ground to go up one, whilst the cart-wheels run in the contiguous furrows. The manure being laid in the furrows, and the sets placed upon the dung, at the distance of about ten inches in the rows, were covered with mould by the plough.

1. A part of the field was manured with stable dung at the rate of 32 to 35 tons, the statute acre.

2. Another part with dung mixed with chopped woollen rags.

3. In one drill woollen rags were made use of alone.

4. In three or four drills, peat-mould and lime were tried, which had been previously mixed upon Lord Dundonald's plan, of three parts of peat-mould to one of lime.

1. The result was, that where the stable dung was most rotted, the crop was the most abundant:

2. Where the woollen rags were mixed with the dung, that the crop was very abundant, but did not appear to have any very evident advantage over the rotten stable dung, alone:

3. Where the woollen rags were used alone, that the crop was bad. It must, however, be observed, that the kind of potatoe planted was of an early sort; and that during the months of May and June (1798) there fell scarcely any rain, so that the land was dried to the roots of the potatoes, and did not give a fair proof of what might have been expected, had the season been more rainy and moist:

4. Where peat-mould and lime were used as the manure, the crop was very indifferent, both as to size and numbers.

The conclusions that I have drawn from this crop, and the observations I have made on others, both before and since, are to the following effect.

* The drill method of cultivating potatoes in a dry soil has been found to have so much the advantage, that it is generally adopted in this country,

1. That with a smaller quantity of good stable dung than 30 tons to a statute acre, a plentiful crop of potatoes cannot be certainly expected.

2. That with this proportion of such manure, a return of from 20 to 30 for one, of the potatoes used as seed, or from 200 to 300 Winchester bushels the statute acre, according to circumstances, will be the result.

3. That the quantity of the crop will depend partly upon the nature of the dung used as manure, and partly upon the seasons being more or less favourable to vegetation. Dung that is the produce of horses well fed, and thoroughly rotted, especially if mixed with night soil, will yield the largest return; that of cows, and the lighter litter dung, will yield a much smaller increase, than the former, in this soil. Much will also depend upon the crop being kept free from weeds, and earthed up at the proper season. The weeds should be hoed out by the hand, and will require going over with the hand-hoe at least twice in the season. The earth should be stirred by the plough in the intervals betwixt the rows, and the earth set up to the plants by means of a double mould board, before they become so large as to be injured in their tops by going betwixt them. Setting the earth well up to the stems is of great importance, because, as the potatoes increase in size, they raise themselves to the surface of the earth, and if they have not a sufficient quantity of mould to shoot in, they either become dwarfish and stunted, or else of a green colour, which are strong tasted, if not unwholesome.

In taking up the potatoe crop, it will be found that it can be done at a far less expense, and with smaller injury, by the means of the plough, than with the fork; it being almost impossible not to wound many with the tines of the fork, especially when the crop is luxuriant.

Respecting potatoes, a question has been started, whether they are an exhausting, or an ameliorating crop; and in the *Treatise on the culture of this invaluable root*, published by the directions of the Board of Agriculture, there is a chapter on the subject, where we find a list of supporters of the opposite sides of the question, leaving the point undecided. In this country the same difference of opinion may be found, and references made to particular fields, as instances, in proof of both; but upon investigating the circumstances attending them, it appeared, that the whole matter turned upon this single point, the quantity of manure that had been used.

There cannot be a doubt but that the potatoe is a root, which deprives the soil, in which it grows, of a considerable portion of that matter, which is essential to the

growth of vegetables: in fact, every crop, that is carried off the land, exhausts it more or less. Hence, if potatoes be cultivated in a soil which is not duly manured, so as to compensate for what is carried away, it will prove an exhausting crop. It is possible to add just such a quantity of manure as shall counterbalance the matter abstracted by the potatoe crop, leaving the ground neither exhausted nor ameliorated; but with the quantity of manure mentioned above, the land will not only bear a full crop, but be left in a state of the utmost fertility, as the productions of the subsequent crops sufficiently testify, and thus prove ameliorating in the full sense of the word.

Curl.—The curl in potatoes is a very serious evil, and every endeavour to discover its cause is meritorious. Upon taking up a potatoe plant which is curled, the set will be found quite hard, and unchanged in its texture and appearance, at a time when other plants, not so affected, have their sets decayed. This hardness in the potatoe, which will produce curled plants, is said to be discoverable when the potatoe is cut into the pieces destined for the sets; and that those, who are conversant in the business, can distinguish the circumstance, on taking it into their hands; and will of course throw such aside.

It has been supposed that a change of seed, that is taking it from distant parts, will prevent, or at least greatly remedy the evil. In this country it has been a practice amongst the cultivators of this root, to get their seed from the south-western part of Scotland, which they find to be very little, if at all, subject to curl; but the same seed, planted here, will in a year or two be subject to this disorder. In the year 1798, I planted about six acres with potatoes of this Scotch seed: there was scarcely a curled potatoe amongst them. The year following, about an acre and a half was planted with the produce of these very potatoes, and at least one-sixth of the whole was curled. The present year, I have again planted about two acres with the seed from Scotland, and with the same success as formerly.

It will most probably be found, agreeable to what Mr. Middleton has observed in his *Agricultural Report of Middlesex*, that this disorder depends upon the mode of cultivation, and upon the greater quantity of dung made use of in one case than the other. The part of Scotland where this seed is procured from, is not near any large town, and hence it is presumed, that a superabundance of manure has not been used in raising them. Again; it has been for some time a practice amongst the cultivators of this root, in a neighbouring district, where great quantities are raised,

invariably to procure their seed from moss land, where the potatoes are grown merely from paring and burning the soil, with the addition of a very small quantity of manure. These potatoes are not so good for the table, but are not subject to the curl.

The kinds of potatoe.—There are many sorts of the early potatoe in use; but that, which has taken the lead for general service, is what is known by the name of the *manly*. This joins to the property of being early, that it is very prolific, and well tasted.

For the late crop.—There are two sorts, which have so far established their character, as in a great measure to supersede the cultivation of any others. These are the *duns*, and *pink-eyes*. Both sorts afford an abundant increase, and are mealy and well flavoured, and will take a preference in the markets where they are known. The *duns* are fair smooth-skinned potatoes, and are in perfection till the spring of the year, after which the *pink-eyes*, (so called from a pink or rose-coloured spot on one end,) come in; and these have the property of keeping good later in the spring than almost any other sort.

The expense of cultivating a potatoe crop is considerable. It appears that it may be estimated nearly as follows:

	£.	s.	d.
Rent of land per acre (customary) containing 7840 yards	-	2	0 0
Three ploughings	-	2	8 0
Three harrowings	-	1	0 0
Dung 50 tons, at six shillings	-	15	0 0
Cutting the potatoes and setting	-	0	8 0
Hand-hoeing	-	1	10 0
Setting up with the plough	-	0	7 6
Getting up and sorting	-	3	0 0
Seed about 15 Winchester bushels to the acre (on an average price of two shillings)	-	1	10 0
		27	3 6

With respect to the return, it has been found that 120 loads, or 360 Winchester bushels, is an ordinary crop; that 150 loads, or 450 Winchester bushels, is a very good one; and 200 loads, or 600 Winchester bushels, is an extraordinary good crop.

Taking 150 of such loads as an average, (though it is rather a high one for this soil,) in the year 1798, they sold at 4s. the load, which would only amount to £30. per acre, which of course would not afford encouragement for the cultivation of the crop, taken singly. The profits must be looked for in the amelioration of the land, which might perhaps be effected more advantageously by other means. It is indeed a misfortune to the country, when the price of a necessary of life does not fetch a profit which will be a sufficient inducement to a cultivator to grow it; which was the case with respect to potatoes in the year 1798. Many persons, having been losers by raising this crop, either gave over altogether, or grew less the succeeding year, the effect of which was severely felt.

150 loads, at 4s. as they sold in the year 1798, will make the crop
per acre - - - - - £. 30 0 0

In the year 1799, potatoes sold at from 8s. to 16s. the load: at the
average of 12s. the same were worth* - - - - - 90 0 0

The present year, (1801) the crop of potatoes has been almost every
where deficient, owing to the extremely dry summer; at 120 loads
to the acre, and at 12s. the load, (which appears to be a fair average
of the market price for the current year,) about - - - 70 0 0

It appears from the above statement, that the profit of a potatoe crop, during the two last years, in situations where they have succeeded, must have been so great as to be equal to nearly the fee-simple of the land on which they have grown. It must be observed, however, that the wet season of the last, and the dry season of the present year, have occasioned a failure of the crop in many soils and situations; and that, under all the circumstances of their cultivation, they cannot be afforded at the market for less than 2s. the Winchester bushel, allowing the cultivator the reasonable profits for his expense, trouble, and risk.

1799. After the potatoe crop had been got up, the ground was ploughed, harrowed, and sown with wheat, in November, after the rate of two Winchester bushels to a statute acre. The uncommonly severe winter which succeeded appeared to have injured the grain much; for on its coming up in the spring, it was so thin on the ground as to occasion apprehensions of a failing crop. In fact, this will always

* Potatoes were sold at 8s. the load, on getting them up, in November. In the spring following they rose to 16s. and as high as 18s. the same load, of three Winchester bushels, in a neighbouring market.

be the case, more or less, with wheat sown at this season, provided the winter proves frosty. When wheat is sown either the latter end of September, or in the spring, it vegetates immediately, and the seed is soon out of the power of many enemies to which it is exposed when sown in November; for in case that a long frost comes on, no vegetation can take place for a considerable length of time, during which period it is liable to be destroyed by birds, vermin, and the vicissitudes of the weather.

In April. Red clover and ray-grass were sown upon the wheat, in the proportion of 16 pounds of the former, and one Winchester bushel and a quarter of the latter, to the statute acre. It was intended to have pressed the seeds into the ground by a roller (which would also have consolidated the earth round the roots of the plants of wheat,) but after a part of the field had been rolled, the roller broke, and the remainder was harrowed with a light harrow, which, as the young plants would be loosened, was looked upon as a bold practice. Every thing, however, went on well. Notwithstanding the wheat was thin on the ground, yet, from the land being in such good heart, the plants increased rapidly, and put out such a number of lateral shoots as to promise a full crop. The grass-seeds came on equally well, and there was no perceptible difference betwixt the parts that had been rolled and those that had been harrowed. It was allowed to be the finest field of wheat in the country, and was sold on the ground in the beginning of August for £53. 16s. at which time wheat was selling at 8s. the Winchester bushel.

From the great height and luxuriance of the crop, it unfortunately suffered greatly from the long-continued wet season which came on soon after. It was generally laid flat, and continued so long in that state that the greater part of the grain was sprouted, and either entirely spoilt, or much injured at the best.

1800. In consequence of the wheat laying so long on the ground, a considerable part of the red clover plants was destroyed. But although this took place, particularly in situations where the wheat was much laid, with respect of the red clover, the ray-grass was not injured in the same proportion; since in situations where the red clover disappeared entirely from this cause, there was nevertheless an ample crop of ray-grass, which shews the propriety of joining it with red clover. Upon the whole, it was so fine a field of hay-grass, that this and the next field of the same size, which had been cropped with turnips at the time this was with potatoes, and succeeded by barley, with red clover and ray-grass, obtained the prize of a silver

cup, from a local agricultural society, for the best crop of hay-grass of the first year. This field produced thirty cart loads of hay, as much as a single horse could draw, or as carts of this country could be loaded with, and might weigh nearly 70 stones each, upon an average.

It was pastured the latter end of the year, the grass worth about £4. which I was offered for it by a neighbour. It is now in the finest order, and may, 1st, either be converted into a permanent ley-pasture, or, 2dly, have another crop of hay taken the ensuing summer, (in which case it must have a top-dressing of dung and lime, with mould,) or, it may, 3dly, be broken up for wheat, if intended to go on in the rotation of tillage.

No. VI. This field, of the same size and soil with the preceding, to which it was contiguous, being tithe-free, had been long under a succession of corn-crops for the last four years: they were,

1. Oats.
2. Wheat.
- 3 and 4. Oats.

Exhausted by this process, and over-run with weeds, it was ploughed, cross-ploughed, and harrowed severely and repeatedly, to get out as many of the roots of the weeds as possible. It was by this means brought into a fine tilth, and then prepared for a turnip-crop, upon the drill system. The instruments, viz. the plough, roller, and machine, were precisely those so accurately and fully described in the Agricultural Report of the County of Northumberland.

The drills were nearly two feet asunder. The time of sowing the seed was about the 20th of June, and so on for a week, until the whole was completed. It was manured with stable-dung, in nearly the same quantity as the potatoes, that is, about 50 tons to the customary acre of the country, containing 7840 yards, or 32 tons to a statute acre. But running short of dung to complete the whole field, a part was manured with peat-mould and lime, (prepared in Lord Dundonald's manner and proportions,) to which were added some chopped woollen rags.

Seven drills were sown with Ruta Baga, or Swedish turnips; part of the field with white-topped Norfolk; a part with red-topped ditto; and a part with yellow Dutch.

Respecting these sorts, I observed that both the Ruta Baga, and yellow Dutch, by affording smaller tops, did not make so perfect a fallow as the other sorts,

neither checking the growth of weeds, nor overshadowing the land to the same extent. The white and red-topped Norfolk seemed nearly equal as to their tops and size, covering the ground completely: but I thought the red-topped turnip was of a more open texture, and did not stand frost so well as the white turnip.

As soon as the plants were got about three inches above the ground, it was turned over betwixt the drills by the plough, the horse going in the interval, which cutting and throwing back the earth from within a few inches of the row of young turnip-plants, and doing the same on returning, reduced the part of the field left to be hoed by the hand, to about six inches in breadth for each drill. The turnips were then hoed out by the hand, to the distance of from ten inches to a foot in the row, and any weeds growing there were also eradicated at the same time. This operation was performed by young boys and girls, who, although they had never seen any thing of the sort before, in a few days became quite expert at the business; so as to complete this hand-hoeing for about 6s. the statute acre. Before the plants covered the land betwixt the drills, the earth was set up against the turnips by means of a horse going up the furrows with a double mould board, as in the case of potatoes; which had the effect of stirring the land, and destroying any weeds that might have come up since the last operation. By these means the land was completely cleaned, and the growth of the turnip-tops prevented all vegetation beneath.

On comparing the drill with the broadcast system of cultivating turnips, I feel no hesitation in giving the drill system the preference; which opinion is gaining ground fast amongst my neighbours, who have had an opportunity of comparing the two methods. To say nothing of the superiour, neat, and workman-like appearance which a field of drilled turnips exhibits in all its stages, there are many circumstances which contribute to give it a decided superiority over the broadcast.

The first is the greater security of the crop from the ravages of the fly. When dung is spread at random over a field, a part will receive a greater proportion of it than is necessary, and another a smaller. Should dry and hot weather come on immediately after the sowing, that dung which is exposed to the influence of the sun will be dried up, and a great part of its juices, and the volatile alkali which it contains, will be exhaled and lost. The seeds that fall in the intervals betwixt the dung, or where there is a deficiency of it, will languish, and perhaps be cut off by the fly or snail, and at any rate will never attain a full size. In the case of the drill method, the dung, being buried in the bottom of the furrows, is excluded from all

evaporation, and the seed, being deposited directly above the dung, is, by the warmth which proceeds from it, brought into immediate vegetation; and the young roots, as soon as the seed germinates, striking into the dung, occasion so rapid a growth, that in a few days the plants pass into the rough leaf, and get beyond the risk of injury from the fly, slug, or whatever vermin have a tendency to prey upon them in their weak state. It would appear that the weak and sickly plants are particularly the objects of these destroyers, rather than the luxuriant and healthy. Vegetables in a certain state of decay, and of a yellow hue, are most sought after and preyed upon by slugs in a garden; and I have taken notice that some turnips, from seeds accidentally dropt in the intervals of the drills where there was no manure, have exhibited a sickly hue, and been preyed upon by some insects, whilst the vigorous plants in the drills escaped. In the course of the last three years that I have cultivated turnips, in seasons where we have experienced the extremes of wet and drought on their coming out of the ground, I have not lost a single plant by the fly; which I am inclined to attribute to the rapid growth of the plants from the causes above enumerated.

Another advantage arises from the being able to stir and horse-hoe the land in the intervals of the drills; by which means the weeds are more early and completely destroyed, at the same time that the ground is more effectually opened.

In land abounding with stones to the degree of some of ours, it appears that it would be almost impracticable to hoe it properly, when sown in the broadcast way: in some situations, it appears almost entirely a bed of stones, which would render the plants inaccessible to the hoe; whereas by the drill method it is easily effected.

The produce of the field thus managed was very great, in those parts where a sufficient quantity of stable-dung had been employed; the turnips running to from five to twelve pounds each. But on the part which had been manured with lime, peat-mould, and woollen rags, the crop was, if not wholly deficient, almost so, the turnips not being above a few ounces a piece, certainly not near so many, as those on the other part of the field weighed pounds. And what proved an additional expense was, that the land not being overshadowed as where the turnip-tops were full and luxuriant, it afforded opportunity to an additional growth of weeds; whereby the expense of cleaning the ground was much increased, as it became necessary to go over it repeatedly to eradicate them.

The circumstance of such a deficiency in the size of the turnips, where a due

quantity of manure cannot be procured, leads to some very important conclusions, both in respect to the growth, and the application of the crop.

It appears that in proportion to the deficiency of manure, (either in quantity or quality,) the drills should be brought closer together, and a smaller distance also be left betwixt the plants in hoeing them. It is quite absurd to leave the same space for a turnip, which we know will not attain the bulk of more than a few inches in circumference, as for another, that will be two or three feet, with the top in the same difference of proportion.

With respect to the application of the crop, when the turnips are raised with the quantity of manure here practised; in the first instance, they are to be carted away for the purpose of feeding cattle in the house, or any other use; the land being, as in the case of the potatoe crop, so saturated with dung, as not only to be capable of yielding an abundant crop, but a succession of others in equal fertility, as the result of the present and similar experiments fully demonstrates. But in the case of a considerably smaller proportion of manure being applied, neither the full crop, above stated, can be expected, nor can that which is raised be advantageously turned to any other purpose, than improving the fertility of the land, on which it is produced. It becomes indispensably necessary, either to feed stock upon the ground, or to augment, by the dung they may produce elsewhere, the manure necessary to give it fertility.

It has been observed, that when the land has been furnished with the quantity of dung necessary to produce a full sized turnip crop, such crop may be carted off, to feed cattle; which, besides the profit afforded by their increased value, will also give rise to the production of such a quantity of manure as will enable the cultivator to proceed, in rotation, to other parts of his farm, on the same system.

The expense of cultivating a customary acre of turnips (7840 yards) may be thus estimated :

	£.	s.	d.
Rent of land	-	-	-
Three ploughings	-	-	-
Three harrowings	-	-	-
Fifty tons of dung, at six shillings	-	-	-
Hoeing, and horse-hoeing	-	-	-
Seed	-	-	-
Getting, drawing, cutting tops, &c.	-	-	-
	22	15	0

The difference of the expense of an acre, cultivated with the full quantity of dung, and the smaller, consisting only in the value of the dung used, (all the other charges being the same,) it is clear, that the advantage will always be in favour of the full manuring; as, exclusive of the superiour immediate return, the dung raised puts a fresh parcel of land into the like rotation of crops.

What the return may be from an acre of such land applied to the feeding off cattle, is not easy to ascertain, as it depends upon so many contingent circumstances; such as the price at which they were purchased; the value of the hay and straw consumed along with the turnips; the price at the time of sale; casualties in a lot of such beasts, &c. I had intended to have fed eleven Scotch bullocks, from about five customary, or eight statute, acres of turnips in the year 1798, which I computed might have afforded a profit of from £4. to £4. 10s. per head; but the severe frost of the 27th of December of that year destroyed the greatest part of the turnips destined for that purpose: the consequence of which was, that I was obliged to break in upon my potatoes, which went off in such a manner to supply the deficiency, that it proved, with other expenses, a very losing bargain. Whatever profits could be gained by this means, taking in their advance, at the most favourable point of view, and the value of the dung produced, in conjunction, they would not have repaid the expense of the cultivation of the land. That must be looked for from the future crops, in consequence of the amelioration produced; and indeed the turnip crop may be regarded as the foundation of general improvement, by cleansing the ground from weeds, and affording a stock of manure for future crops.

There is, however, another mode of disposing of the turnip crop in certain situations, and where there is a command of manure for purchasing, that affords an immediate advantageous return, so as to compensate in the first year for all the expenses incurred.

In November, 1799, I sold, in lots upon the field, two acres, statute measure, for £46. exclusive of the turnips used for four cows, which might amount to nearly £5. more. The other half of the field in which these grew was sown with Swedish turnips, (*ruta бага*,) which I sold in the spring following for 2s. the Winchester bushel. By this management, the land was made to produce an immediate reimbursement of all the expense incurred, with a handsome profit; at the same time that it was thoroughly cleared of weeds, and made capable of carrying the

crops, that will occur in the intended suecession, all of them valuable, and without exhausting the soil.

The present year, pursuing the same system, the land being prepared and fully manured as before described, the following has been the return of about twelve acres and a half statute measure.

	£.	s.	d.
Turnips, * six acres and a half, sold for	-	-	-
Potatoes, about two acres and a half, 170 loads (of three Winchester bushels) at only 10s. per load	-	-	-
<i>Ruta бага</i> , three acres and a half; there are 80 drills, which I am now selling at 2s. the Winchester bushel; each drill contains from 15 to 18 bushels. But supposing they only neat £1. each	-	80	0 0
			310 13 9

It must however be observed, that this plan cannot be pursued, except in situations where a populous country affords a market, and the vicinity to a town gives an opportunity to purchase manure, which costs me about 6s. the ton upon the ground.

Preserving turnips.—As turnips are subject to be destroyed by very severe cold, which occurs sometimes in the course of three or four years, and occasions by that means a great loss to the farmer of winter food for his cattle, various methods have been resorted to for the purpose of ensuring their preservation. That which has been most commonly practised in this country, is what is called *bogging* them. They are taken out of the ground, the tops and roots cut off, and placed in a row of about a yard broad at the bottom, and a yard in height, tapering to the top; they are then covered over with mould of such a thickness as it is supposed will resist the impression of the frost. By heaping no greater quantity upon each other, they are less apt to heat than if the same aggregate was thrown together in a round heap.

It is, however, certain, that after turnips have been pulled any length of time, they begin to sprout, in consequence of which they become spongy, are less relished by cattle, and are less nutritious. They are (beyond all comparison) the best, when fresh pulled.

Ruta бага, or *Swedish turnip*.—I mentioned that I had sown a few drills of this

* This crop obtained the price of a silver cup from a local Agricultural Society.

turnip in the year 1798. These attained a good size, and were not at all affected by the severe frost of that winter, which destroyed the general crop of other turnips. The thermometer fell on the 27th of December of that year to 12 degrees of Fahrenheit, which is an intensity of cold that the common turnip cannot withstand. It is certainly an acquisition of no common magnitude to have a winter food for cattle which is inaccessible to frost, so that it can at all times be taken fresh from the field where it grows, (for however the ground be frozen, they may be got up by means of a pick-axe,) and which continues in perfection through the whole spring of the year, so late as the month of May, and until grass springs again. These properties of the Swedish turnip point out the propriety of its constituting a part of the winter food, at least of every person who has a stock of cattle. It seldom happens that any frost, so severe as materially to injure the turnips, occurs before Christmas: and if the common sorts were to be resorted to until about that period, and the Swedish for the remainder of the season, we should have so certain a supply, as to bid defiance to any inclemency of weather.

There is one circumstance, attending the cultivation of the Swedish turnips, which deserves attention; which is, that they will not come to a good size except with a large quantity of manure, (stable dung.) I have understood that they have been tried in many places in this neighbourhood, and fallen into disrepute from their not acquiring any greater size than a carrot, which has been owing to the circumstance alluded to, as I have myself found to be the case where the full quantity of dung had not been used. It appears too, that, from this circumstance, the drill system is particularly suited to the cultivation and growth of this species of turnip, as the roots are so certain to meet with dung beneath. Those I have raised, particularly the present year, are of a good size, as large as eight or nine pounds weight. They are so much more solid than the common turnips, that on weighing a load of three Winchester bushels, of each, the one weighed 180 pounds, whilst the other was 264 pounds weight.

It is recommended to sow the seed in May, in order to give this species of turnip an opportunity of acquiring its full size: although circumstances have hitherto prevented mine from being sown earlier than the first week in June, they have acquired a very tolerable magnitude; but, perhaps, it might have been better, had it been done at an earlier period.

For the table, they are certainly the best turnips that have been yet introduced ; and, where they are known, bear a decided preference in the market. *

No. VII.—A poor ley field, over-run with ant-hills, was in part limed, at the rate of about 300 Winchester bushels to the customary acre of 7840 yards, three years ago.

Another part was limed in the same manner, about a year ago.

Another part had marle spread on it, at the rate of 100 tons to such acre, the last year.

Another part was manured with chopped woollen rags, at the rate of 120 stone to such acre.

This field was ploughed and sown with oats the last year. On comparing the produce of the respective parts of the field—that which had been limed three years ago was by far the best crop, yielding a return of nearly ten for one of the seed sown.

The others had all a visible improvement, but not in the same degree. When either lime or marle is spread on the surface of the earth, a considerable portion of time is necessary to elapse before these can be properly incorporated, without which their fertilizing effects are only incompletely produced; the woollen rags produced a verdure in the stalks of the grain, whilst growing, superiour to the others; but I am inclined to think, that woollen rags also require a length of time to decay, and to produce their effects in full perfection, as the crop did not come up to that from the part of the field, limed three years ago.

The usual manner of applying lime in this country, (where it is much used,) is either by spreading it on the sward, or by mixing it with mould.

When it is to be spread on the sward, it is laid in heaps, until the moisture, which it attracts from the earth, or from the rain, has caused it to fall, or be resolved into an impalpable powder. At this precise point of time it is spread on the surface of the earth, and if a rainy season soon follows, it is speedily washed into

* I am sorry to observe an inferiour variety of the turnip becoming more general, for these two last years : it is not distinguishable whilst growing, but is upon pulling. The kind is white, whilst the true *ruta baga* is yellow ; this puts out large tap roots, which renders it unsightly, and less marketable, whilst the other is round and compact as to its roots. It is also less palatable for the table. Great attention will be necessary on the part of those who raise the seed, to get rid of this species, otherwise this turnip may get into unmerited disrepute.

the ground, with the soil of which it gradually incorporates; but it would appear, that it requires two or three years to do it so effectually, as to give its full effects on the crop that may be taken, or on the vegetation previously growing.

In strewing the lime on the soil, it has been observed, that it is particularly requisite to notice the state that it is in; for if it be strewed before it be slacked into a fine flour, should dry weather come on, the fixed air, or carbonic acid, will be gradually attracted by the quick lime, and it will be re-converted into lime-stone, of various sizes, never afterwards divisible into a fine powder, (on which circumstance all the virtues of lime, as a manure, depend,) but will remain no better than lime-stone gravel, which it in fact is.

Another method of applying lime, by which its operation is more immediately answered, is, by fixing it in alternate layers, with soil. The moisture contained in the mould is absorbed by the quick lime, which causes it to swell and slack.

If it were to be allowed to remain in this state long, the same property in the lime, which occasions it to harden in mortar, would operate here, and it would run into hard lumps, indivisible in the ground. Hence, it becomes necessary, in the course of a certain number of days, to turn the mass, by which means the lime is mixed with the earth, and its minute particles brought into contact with other substances, and kept in a state of separation. It will be still better effected, if the heap be, in the course of a few days more, turned over again with the spade. It will then be in a proper state to be set upon land, to be mixed with dung, or applied to any other purpose of husbandry.

Upon comparing the different parts of the field in question, the part that had been limed three years ago appeared to have made a return of ten for one of seed sown; the parts that had been manured the year before, with lime, with marle and with woollen rags, each, about six for one; that which had no manure at all, a miserable crop, of not more than three or four for one.

Nothing can evince more strongly the necessity and advantage of liming these poor worn-out lands, before breaking them up into tillage, as well as of allowing the lime to remain the time necessary to produce the due change in the soil. Besides, had the land been limed, it would have carried two good crops of oats, before it was manured with dung, either for barley or turnips, or potatoes, as the cultivator might think proper. In the present state, with the same expense of seed and labour, and with not half the crop in the first year, it would be perfectly absurd to

expect any crop the second. In the case of this field, it is proposed to work it into a fine tilth, and afterwards, with the manure, to take a crop of potatoes the ensuing season, which, it is supposed, will put it into a state of fertility. It, however, has been found, that no addition of dung will communicate the same power of vegetation to land, which has never been limed, as to that which has. This is, I think, agreeable to an observation of Dr. Anderson's, which I have seen confirmed in a variety of instances. In a field of turnips, of the present year, where the soil and manure applied were perfectly equal, a part, which had been limed two years before, produced the turnips of nearly double the size of the other.

Paring and Burning.

This is the common and successful practice on the moss lands; but it has been rarely resorted to in the dry soil of the up or hard land. In one instance where it was tried in the taking in a common, and appropriating it to tillage, one good and one indifferent crop of oats were obtained; but the land upon which it was practised has been ruined ever since, and is at present almost entirely unproductive. In fact, if the land which is mossed over, be limed, and, in due time, ploughed, the moss which has been produced, will gradually decay, and, by rotting and uniting with the lime and other manures, will be a source of fertility to the succeeding crops. The destruction of this vegetable matter by fire, although it may afford the food for a plentiful crop, for one, or, at most, two years, is, in such soils, a most wasteful and ruinous practice.

Instruments of Husbandry.

The ploughs, which were in use in this part of the country, were upon no particular construction. Every man had his own from the maker, which was a good working, or an indifferent one, as it turned out, just as a vessel is a prime or a dull sailer. They were mostly drawn by four horses (seldom so few as three) in a line, with a boy to drive, and a man to hold.

The farming servant, whom I engaged, being from the county of Roxburgh, where Small's plough was in use, he procured one of them, which has been found to answer remarkably well in the soil of the composition that ours is, and which may be ranked under the light loams.

The advantages of it are, that, being drawn by two horses abreast, with the man who holds the plough to direct them by means of rope-reins, it does the work

equally readily, and, if necessary, to a greater depth, than the common ploughs of the country with four horses and a man, and a boy for a driver. The advantages, which this plough has over the others, appear to be from the symmetry of its parts, and the formation of the mould board, which is of cast-iron, and so constructed as to afford the least possible unnecessary resistance in passing through the earth; and in giving the horses the greatest purchase in their draught, by placing them near the plough.

The least variation in the formation of the mould board, or in the proportional distance of the respective parts, destroys the effect. This plough has been attempted to be copied by various plough-wrights in the country, not one of which has constructed any like the original.

The plough is very well known in the neighbourhood of Dalkeith, in Scotland; by the Agricultural Society of which place it is recommended. Many are now sent for into this country, from a conviction of their superiour advantages over the common ploughs.

With respect to the harrows, and other instruments, they do not differ from those commonly in use. In the application of the harrow there may be some variation: it is commonly only applied for the covering of the seed that is sown: but if the land be clodded, and requires to be wrought into a fine tilth, repeated and severe harrowings with a heavy harrow will best effectuate the purpose.

Conclusions.—I. That old poor ley, broken up by the plough, without any manuring, will scarcely carry a crop, that will repay the cultivator his labour and expenses.

II. That if this land be limed, after the rate of about two hundred Winchester bushels to the statute acre, and be allowed to remain three years before it be broken up, it will then give abundant crops of oats, for two successive years.

III. That the land will then be in a proper state for a crop of barley, sown with clover and other grass-seeds, if it be the object of the cultivator to return it to grass, immediately: or, what is more profitable, and cleanse the land better from weeds, for a crop either of potatoes or turnips. In both these cases, it will be necessary to manure with dung: if for barley, at the rate of about eighteen tons the statute acre; if for turnips or potatoes, at the rate of from thirty to thirty-five tons the statute acre: and that, with this quantity of such manure, the crops will be ample, and the ground be left in excellent condition, adequate to the production of various succeeding ones.

IV. If the barley succeed the oats, and a permanent ley be intended to be produced as soon as possible, a mixture of white clover, ray-grass, yellow trefoil, and rib-grass, should be sown with the barley, to form the sward; and if a few pounds of red clover were added, this would ensure a greater produce the first year. In all cases, it will be preferable to pasture such land the first year or two, after it is laid down for grass; because mowing contributes to keep the sward thin, and promotes the reproduction of moss.

V. If it be intended to go through a longer routine of husbandry before it be reconverted into grass land, the most eligible method seems to be, to follow the oats with potatoes or turnips; the quantity of manure used, and the previous preparation of the land, being the same. Of these crops, the potatoes appear to be the most profitable. The turnips are best turned to account, by carrying them to a market, provided a near one offers; but, if at a distance from one, they afford the means of maintaining an additional number of cattle, and thereby of procuring the quantity of dung necessary for going on with the present scheme of husbandry.

VI. The ground, having been thoroughly cleaned from weeds by the turnip or potatoe crop, and well enriched with manure, is now fit for the production of any crop: should it be the object of the cultivator to convert it immediately into grass, the clover and grass-seeds may be sown without any intervening crop, which will ensure it in extreme luxuriance: or, what is more profitable, a crop of wheat or barley may be first taken, the clover and grass-seeds being sown with either.

VII. The land thus laid down in grass is advantageously applicable to any of the purposes of husbandry. It may remain as grazing or mowing land, or be broken up for oats or wheat, (if it be intended to go on in the system of tillage,) as one or the other plan be best suited to the views of the cultivator.

Moss, or Peat Land.

A part of the farm, consisting of about seven acres, is moss land, producing peat and turf for fuel. After it is cut down for this purpose, to a certain depth, and drained, it becomes capable of bearing good crops, (of turnips and oats particularly,) but for this, it is always pared and burnt, to such a depth as the discretion of the cultivator directs him. The prejudice I had taken against this practice, from reading Lord Dundonald's treatise respecting it, was so great, that I was determined to reject it almost totally, and to try what could be produced without it. The

result, however, has been, that, where the parts were burned, an immediate fertile crop was the consequence, and that, not only for the first year, but the ground has exhibited an improved state in all the successive crops, beyond comparison better than where this process was not employed. The greater part of the field, not having been pared and burnt, is at present, in so wild and unproductive a state, that I intend to extend the operation to the whole of it, in the ensuing spring. Whatever objections there may be to the paring and burning land, where there is only a small portion of vegetable matter contained in its composition, there can be none to converting from three to six inches of the surface of a moss into ashes, when there will be many feet remaining of this same substance. Paring and burning not only affords a cheap manure, (for the completion of the whole process will be undertaken for fifteen shillings the acre,) but the mechanical texture of the land is changed. From being an open, spongy, light substance, in which no valuable vegetable can get root, it is converted into a more compact substance; to which if marle or clay be added, from an useless barren soil, a most fertile one is produced.

What follows on this subject, is for the purpose of shewing what should be avoided, not imitated. The pointing out practices, that will prove unsuccessful, may prevent others from committing the like mistakes.—*Felix quem faciunt aliena pericula cautum.*

A moss field, in 1796, had been drained perfectly, so that the greater part was quite dry and spongy. It produced some herbage, and was pastured until October; I then carted a considerable quantity of hard soil from the adjacent lands, upon the spongy part of the land, to render the soil more compact.

In 1797, April 8th, the field having been covered with soil from the hard land, and a certain portion of it pared and burnt, it was ploughed and sown with an early kind of oats, at the rate of about five Winchester bushels to a statute acre.

June 14th, the crop in general totally failing, except where dung had been dropt by the cattle, or where it had been pared and burnt; there the grain is luxuriant in the extreme.

Cut it in the beginning of September, but it was hardly worth reaping, except where it had been pared and burnt; there the grain was tall and strong, and the heads full and heavy.

1798.—The field was ploughed and manured in this manner:—a compost of stiff clay was mixed with fresh lime in layers, and then turned over, twice; allowed

to lie all the winter; then mixed with a good proportion of stable dung. The land was then ploughed in furrows at about two feet distance, in the bottom of which this compost was laid. On some parts turnips were sown in the drill method; on another potatoes were set.

The crows, from a neighbouring rookery, pulled up at least half an acre of the turnips, after they had got to a good size, searching, as I suppose, for small insects and worms which adhered to the roots, now struck into the manure in the furrows. If not prevented, they would have destroyed the greater part of the crop. I was obliged to hire children to drive them away, as no scare-crow answered that purpose.

Are crows and rooks in any way advantageous? They destroy grubs and worms; on the other hand, they pull up potatoes both when first set, and when ripe: they will destroy grain in all its stages; in particular, late-sown wheat or barley is greatly injured by them, where they are numerous. In the reign of Henry the Eighth, these birds were become so numerous, that statutes were made for providing nets and other means to reduce their numbers; doubtless from the mischief they occasioned.

The crop of turnips produced was uncommonly luxuriant in the tops; and where the dung was plentiful, in the roots also. But it was almost totally destroyed by the severe frost which came on about Christmas; and is a proof that there is no dependance on any turnip crops for spring food, except the *ruta бага*, or Swedish.

The potatoes were a moderate crop, and from the various manures employed, I now find that peat-mould and lime, cannot be put in comparison with dung. The quantity of produce has been uniformly correspondent to the dung employed. Some carrots were also sown on a part that was well dunged: the crop very good. The nature of this land being open and without stones, allows the roots of the carrot to strike deep and freely. They were eaten with great avidity by horses and cows; so that I strongly recommend a more general culture of this root: I observed that some which were left in the ground, stood the severe cold of the winter unhurt, in 1799. This field was ploughed once, (it being in so fine a tilth as to require no more,) and sown with barley, together with white clover, 12 pounds to the acre; rib-grass, two pounds; ray-grass, one bushel and a quarter; then rolled well, to compact the surface of the earth, which is now mixed with soil, clay, lime, and dung.

September.—The crop came up very thin as to barley, the stalks short, the heads small and light, except where the paring and burning had been practised; here the crop was good. On the parts where the carrots grew which had been well dunged, the barley was so luxuriant that it was laid by the wet weather, and mostly spoilt. The crop of grass is, however, luxuriant, even where the barley failed: this is a consoling prospect, as it was my object to get it into pasture land.

1800.—It had been intended to pasture this field; but it being at a distance, and other circumstances, obliged it to be mown for hay. Contrary to expectations it proved very thin indeed; the ray-grass, which at first appeared so luxuriant, became thin and dwindling; the white clover almost entirely died away, except where cattle had dropt dung here and there, and the land still retaining that light spongy texture, which is not suited to the maintenance of any good grass. On the other hand, the parts that were pared and burnt appear covered over with a close sward, especially of rib-grass, which, it would seem, is particularly well adapted to this kind of soil.

The conclusion which I am induced to draw, from a survey of the whole proceeding, is, that in consequence of the mistake in the outset, of omitting to pare the sward of tough loose spongy roots, and burn them, agreeable to the usage of the country, I have lost three good crops, which would have paid for the fee simple of the land; and that all the extra expense I have been at is, if not totally thrown away, at least of little utility. I have therefore to begin *de novo*, and intend this year, to pare and burn for a crop of turnips, and also to raise seed potatoes; those, which are produced on moss land with little dung, being, as we have seen, not liable to be affected with the curl. This preparation will, I am informed, be also sufficient to carry a good crop of oats, with which grass-seeds will be sown, for a pasture-field the year following.

No. XII.

An Essay on the Conversion of Grass Land into Tillage. By Dr. Wilkinson, of Enfield.

— NON SIBI —

THE inquiry of the Board may be divided into three propositions:

1. The most successful method of converting grass land into arable.
2. The course of crops which should be pursued, to produce the supply of corn required, without exhausting the soil.
3. The most advisable method, of restoring the land thus brought into tillage, to a state of sward.

As a preliminary inquiry, the practical agriculturist is naturally led to reflect on the value of old sward, before he determines to disturb it with the plough. If a landlord,—he should recollect, that it is in the power of the tenant to exhaust arable more than grass land :—that he will eagerly embrace any opportunity of ploughing up fresh land, rather than be at the expense and trouble of bringing into order what has been already exhausted by frequent corn crops :—that it will require more frequent and expensive manuring to support corn than grass :—that with the quantity of grass, the number of cattle kept on a farm will probably be reduced, and the supply of dung lessened, while the demand for it is increased.

Whatever course of crops may be adopted, six years should be allowed, after the land is laid down again, before it can be expected to regain its pristine vigour. It should be recollected, that of the grass-seeds which you sow, the greater part will probably disappear in a few years, and to the natural grasses you must trust for the reproduction of sward, which will be a very tedious process, unless the land is well manured, and kept constantly grazed.

Grass land derives additional value from the important discovery, that preserved after-grass may be used with success, as a substitute for turnips. For these last two years, I have depended on it principally for the support of above 200 sheep. From the time of mowing, the meadows are shut up, and the grass preserved till after Christmas, when it proves a very seasonable supply to the ewes and lambs. It is not injured, like turnips, by a succession of frost and thaw. The succeeding hay crop I have found, by experience, receives no detriment from the practice.

It should be recollected, that an estate increases in value in proportion with the quantity of grass land; and that it will decline in value, as the sward is diminished. I met last year with a remarkable instance of the above; an estate, of 100 acres arable and 50 grass, fell under my own observation, which had been so ruined by cropping, that the arable was a complete mass of weeds, and had it not been for the extent of grass land, it would have been difficult to have found an experienced farmer, willing to embark in the arduous undertaking of bringing it into order. It will, I think, from the above considerations, be readily allowed, that only in two cases should old grass land be disturbed with the plough.

1. Where its appearance is unhealthy, either owing to coarse herbage, moss, or rushes:

2. Where the exigency of the times, either owing to a deficient crop, or to an increased population, requires a more abundant supply of corn.

Having made these preliminary observations, I return to my first proposition, which regards the most successful method of converting pasture land into arable.

I consider old turf as an accumulation of vegetable food, the plough as the instrument which opens these stores, and grain as that produce to the support of which they are most congenial. Turf, which has been long grazed, or frequently manured, becomes a receptacle of animal and vegetable matter, which supports a luxuriant spring of grass. In times of scarcity the thought is consolatory, that it is possible to take advantage of this collected mass of manure, to supply the increasing demands of the country, and to furnish the poor with bread.

Though old sward, as containing an accumulation of animal and vegetable matter, may be considered as a storehouse of manure; yet it must be remembered, that in this storehouse lurks a deadly foe, I mean the worm, whose ravages are frequently so destructive to the first corn crop when got in on one ploughing. I have this year known old grass land ploughed up, and sown with wheat in this manner, but

I consider the experiment as too hazardous to be recommended for so expensive and valuable an article.

The best plan would be, to let the land lie rough during the winter, that the frost may break and pulverise it, so that the harrows can collect mould in sufficient quantity to cover the spring corn.

On stiff land, oats are the most proper crop, on account of the strength of the root, which easily penetrates the turf. But considering the process with a view to the speedy production of wheat, the main object recommended, oats are by no means an eligible crop to precede that valuable grain. I would recommend beans on stiff land, and pease on light soil. After these, wheat will follow in proper order, though the turf will still be not so much destroyed as to prevent injury from the worm. Every means of securing the wheat becomes important, and with this view I can recommend paring and burning, as the most certain preservative from the worm. Here I am not indulging in theory or speculation, I speak the language of experience. I have broken up large quantities of grass land for corn, which generally suffered from the worm, unless where the turf had been previously pared and burnt. By means of this preparation, I have grown the most luxuriant crops on the same land where the worm had proved so destructive.

This, I would observe, is entirely a practical question, though the inquiring mind will naturally search into those causes, which may be considered as conducive to the success of the experiment. In paring, a considerable quantity of earth adheres to the roots of the turf; this certainly cannot be dissipated in the process of burning, but becomes intimately united with the ashes. Hence, from common earth, it becomes itself a rich and powerful manure, not only stimulant in quality, but considerable in bulk, and equal in effects to any dressing which the expenditure of five pounds per acre could purchase. If the land is stiff, the clay becomes by its hard particles, a mechanical manure, and keeps the earth light and porous, which facilitates the extension of the roots of plants. I have observed this effect of lightening the land, as I followed the plough four years after the operation had taken place.

Besides securing from the ravages of the worm, and opening the soil, by consuming the coarse grass, it prepares the way for the introduction of clover, and a sweeter sward. I have heard Gentlemen, concerned in breaking up waste lands, regret that they have not adopted this process, as they found the coarse grass springing up when the land was suffered to rest, and thus injuring the growth of the clover and the

finer bents; the land was so far from being injured by the process, that the rent was doubled on a piece of 20 acres, where I had pared and burnt the sward, though when it was let, five years had elapsed after the process had been completed, during which time the land had been cropped, without receiving the additional stimulus of any other manure.

The richest grass land will frequently prove the most dangerous matrix for a wheat crop, in proof of which, I must mention an experiment on five acres of grass land, where the wheat entirely disappeared, having been taken by the worm; but on harrowing in oats in spring, I reaped at harvest six quarters per acre, where the wheat had been entirely destroyed.

The second proposition respects the course of crops to be pursued, to produce the supply of corn required, without exhausting the soil.

The crops must be regulated by the process of breaking up the land.

Where the land is, during the course of the summer, pared and burnt, wheat will of course be the crop sown in autumn. After the ample manuring of the ashes, considering the exigency of the times, oats might follow, as an article which may be converted into food, though in a common course of husbandry, I should not recommend two crops of white corn to follow without the intervention of turnips or the leguminous plants. On twenty acres pared and burnt, I had wheat three quarters per acre, and oats seven quarters per acre in close succession. I conceive, therefore, that this course would be best adapted to the object in view, which is to break up grass land for a temporary supply, after which it is to be returned to a state of sward. Grass-seeds in this case might be sown with the oats, to the success of which the stimulating powers of the ashes, not yet exhausted, would greatly contribute. Instances have been known where coarse grass has been pared and burnt, and grass-seeds scattered immediately among the ashes, and though the land has not been ploughed, the experiment has succeeded.

Should the turf be broken up without paring and burning, a very different course of crops must be adopted, and a considerable time must intervene, before the land can be again returned to a state of grass.

On stiff land, where wheat is the grand object, and which I suppose to be ploughed up immediately in a state of sward, the course I apprehend should be,

1. Beans.
2. Wheat.

3. Tares on the wheat stubble dunged.
4. Wheat.
5. Turnips fed with sheep, unless too wet for that crop, in which case beans manured.
6. Oats or barley with grass-seeds among the corn.

This supposes the land to be kept under the plough for six years. The two wheat crops are brought as near as possible to the beginning of the course, to meet the exigency of the times. Two dungings would, however, be necessary, though, perhaps, they need not be very heavy; the first with a view to the second wheat crop, and the second to fix the turnips and the grass-seeds. The difference of expense between the two methods of cultivation is considerable.

If you pare and burn, you get two corn crops, and return the land to grass in three years, without the purchase of any additional manure. In the latter case you gain three corn crops in six years, and are obliged twice in the course to purchase manure.

If the necessity of the times did not require immediate corn crops, I would recommend,

1. Pare and burn.
2. Wheat.
3. Tares.
4. Wheat.
5. Turnips manured and fed on the land with sheep.
6. Barley or oats with grass-seeds.

Another query suggested by the Board is the depth to which grass land ought to be broken up: I reply, no deeper than is necessary to turn the turf. The main object is corn immediately; whereas if you plough too deep, you bring up a crude unfertile soil, which will probably require a course of cultivation to complete its improvement. By ploughing some stiff land to a considerable depth with a strong ox team, the staple of the soil was buried, and I found it was three years before the new surface could be brought to a fertile state.

In regard to the principle which should regulate an increase of rent, where the tenant is allowed by the landlord to break up old grass land, I should suppose that a corn rent would be most satisfactory to both parties. The experiment would probably be but temporary, for about six years, and the hazard I conceive would

be greater to the landlord than to the tenant, as in case of litigation, it would be difficult to compel the tenant to take all necessary care, in laying down the land again, and it probably would be several years before it would be brought again to its former value as meadow or pasture land.

It may be observed here, that where the land is cold and wet, lime may be applied with great advantage to the quantity of 100 and 60 bushels per acre, which I have found, by experience, renders the land drier, and the season earlier in the ripening of the corn, and when laid down to grass, the herbage will prove sweeter.

In Gloucestershire, when grass is converted into arable, they generally, after breaking up the sward, let it lie fallow during the summer, and prepare it for wheat, which, in some cases, is followed by a second crop of the same corn; so favourable an idea do they entertain of old sward as a matrix for wheat.

I proceed now to the third proposition suggested by the Board, *viz.* The most advisable method of restoring the land thus brought into tillage, to a state of sward.

This proposition, I consider as one of the most important, which can engage the attention of the practical agriculturist. It is interesting not only to individuals, but to the country at large. England is famous for the richness of her pasture land. In France, I am informed, they have attempted, without success, to convert arable land into productive grass. The failure may in part be attributed to the exhausted state of their arable lands, by successive corn crops, before laying to grass. Wisely, therefore, has the Board guarded against this, by pointing out the necessity of laying down the land in an unexhausted state. Having paid some attention to this subject, I shall mention the result of my own experience. The following directions, if attended to, will, generally speaking, prove successful.

Let your land, in the first place, be clear of weeds, and in good heart.

2. Graze it constantly with sheep, and for the first six years never suffer the scythe to touch it.

3. Manure frequently, and do not neglect draining, should springs abound, or should the land be subject to the stagnation of surface water.

The directions, given in the second proposition, provide for the land being cultivated without being exhausted. Supposing the grass-seeds to be thrown in with the barley or oats, I have generally used them in the following proportions:

White clover, 12 lbs.; broad clover, 4 lbs.; trefoil and rib-grass, of each 4 lbs. It is of consequence that a full quantity of seeds should be thrown in.

Let it be manured the first year, soon after the corn is off, which will greatly contribute to the luxuriance and support of the grass-seeds.

If clean hay-seeds can be procured, a sack an acre should be sown, before the dung is laid on. I suppose it now to be grazed with sheep for three or four years, when notwithstanding all that has been done, the land will sometimes put on a very unpromising appearance, and in such cases it has unadvisedly been ploughed up, as incapable of bearing grass.

The cause of this is, that the grasses sown begin to disappear before the spontaneous grasses have gained much strength. The grasses sown have hitherto, we will suppose, occupied the ground, and as these disappear, the natural grasses should be encouraged by another dressing of manure. For this purpose, I have frequently used coal ashes with great success, to the amount of three chaldron per acre. I have laid of this manure on grass land above 50 chaldron in a year.

About eight years ago, I laid down a field of 12 acres with broad clover principally, intending it to stand only for two years. In the summer it was mown twice, next year it was grazed; the clover was but weak. As I had particular reasons for altering my mind, and for wishing to continue it in grass, I resolved to try the effects of grazing it with sheep.

On the fourth year it looked so very bad, the clover almost entirely disappearing, that I was tempted to plough it up. I, however, resolved to continue the grazing, and to give it a dressing of three chaldron per acre of coal-ashes.

The next year, I observed the white clover and natural grasses beginning to form a close turf, and the field is now an excellent piece of sward, without the aid of any hay-seeds.

I have found folding of great advantage in fixing and forwarding the white clover. Coal-ashes will produce this clover on wet land; but unless the land is drained, it will soon grow weak or disappear. As one grand object in producing sward is to keep the land in good condition, I shall make some observations on those manures, which I have found of service in forwarding grass.

I would previously observe, that I have found manure produce the strongest effects when laid on early in the autumn, or on meadow land immediately after mowing.

1. Scrapings of the road, or sand drift, will be of great service in producing a sweet herbage. Wherever the sweepings of my own walks have been laid on an

adjoining common, I have observed the coarse grass disappearing, and the fine bents shewing themselves. I have a field now in my own occupation, which, from a piece of coarse herbage, has been brought into such a luxuriant state of sward, that it is esteemed the best piece of grass land in the parish. The improvement was in part owing to its situation near a brook, which brought down, from a contiguous common, a quantity of leaves and sand drift; these were carefully collected and laid on the meadow every year.

2. Fold-yard liquor.—Having laid down a field to grass immediately adjoining my fold-yard, which was situated above it, by means of pipes and trenches I had the liquor from the fold-yard conducted over the field, after having collected it in a reservoir. The effect of destroying coarse grass, and producing a sweeter sward, was very remarkable.

3. The application of marle.—On this subject I shall only mention one fact, which is, that I have known marle successful in fixing the white clover on strong cold land, from which it is very apt to disappear.

4. Irrigation.—The effects of this are powerful in the reproduction of sward, and where this could be had at command, land might, with great facility, be broken up for corn, and afterwards returned to a state of meadow. In two different meadows, which, during the winter, were frequently flooded, I have pared off part of the turf, and have observed, that the ground became green the first year, and on the second it was so covered with grass, that you could with difficulty distinguish where the sward had been taken off. I have known the same land pared a second time in three years, and speedily covered again with a coat of sward, after having been frequently flooded.

5. Soot.—I have used this as a top-dressing, but have not observed the effects to last beyond the first year. I have tried it to the amount of 60 bushels per acre, at 8*d.* per bushel; perhaps it should be used in larger quantity. Lime is nearly as dear, and of that I have used 160 bushels per acre on arable land. If I use soot again, I shall lay it on to that amount.

6. Sugar-bakers' scum.—I have used this with great success, to the amount of two loads an acre, at half a guinea per load. It is a strong warm manure, and serviceable on cold land: its effects are permanent.

7. Tallow-chandlers' graves.—This is one of the strongest manures, which the animal kingdom can furnish. When laid on grass land, it should be either spread

very thin, and broken into small pieces, or applied in compost with mould. I have used it to the amount of a ton an acre, at half-a-crown a hundred weight. The grass was rendered so rank, that for some time cattle would not touch it, and the hay was too coarse for sale. On account of its rankness, I generally use it mixed with mould or ditch earth. Its effects are visible for some years after it has been laid on, in the superiour verdure of the grass. On trying it for barley, it made the straw so rank, that it bore scarcely any grain; and the best method of applying it to arable land is to the turnip crop, where I have found it far superiour to dung. I have been the more particular in mentioning its effects, as I have not found it noticed by any of the writers on husbandry.

8. Night-soil.—The effects of this manure have been abundantly proved both in Flanders and the neighbourhood of London. The quantity used on grass land is about three loads an acre. It is a stronger and more permanent manure than common dung. It is to the animal kingdom that we are indebted for our richest dressings.

9. Coal-ashes, which I have already noticed.—The good effects of common dung are too well known to need mentioning.

10. Woollen rags.—These are not generally used as a manure on grass land, yet when chopped small, I have spread them with advantage on young clover before winter, to the amount of about 10 cwt. per acre. On arable land I have used them for barley, with considerable effect; the quantity two ton to three acres, at five guineas per ton, the soil a light loam or gravel.

I have been enabled to use some of the above manures on a large scale, having contracted for all the dung of a considerable brewhouse where 32 horses are kept; for the sugar-scum of two sugar houses, and for all the graves made by two considerable melters.

I manured last year 34 acres for wheat, and above 20 acres of grass land.

No. XIII.

Essay on the best Means of converting Grass Lands on the various Soils into Tillage, without exhausting the Soil; and of returning the same to Grass, after a certain Period, in an improved State, or at least without Injury. By John Boys of Betsanger, near Sandwich, Esq.

AND SOME
 • • • • •
 HAVE HELD THE SCALE OF EMPIRE, RUL'D THE STORM
 OF MIGHTY WAR, THEN, WITH UNWEARIED HAND,
 DISDAINING LITTLE DELICACIES, SEIZ'D
 THE PLOUGH, AND GREATLY INDEPENDENT LIV'D.

THE writer of the following pages, having seen the advertisements of the Honourable Board of Agriculture, offering premiums for Essays on the best means of converting grass lands into tillage, and returning the same to grass, is induced to offer his thoughts for their consideration.

When a man writes for the instruction of others, it is incumbent on him to disclose his pretensions to information. The writer founds his experience on having been 30 years past in the occupation of a large tract of land, a great part of the time with from 10 to 13 hundred acres in his possession, of almost every kind of soil. What he here submits to the Board, is the result of such observations as his abilities have enabled him to make during the above period.

IN order to effect the purpose required by the Honourable Board of Agriculture, it is necessary to point out the best modes of breaking up grass lands on the different kinds of soils, separately; for that which is good management on one soil, may on another be quite the reverse: they are therefore classed, nearly as pointed out by the Board, in the following order.

1. Clay, in all its distinctions, and soils too strong or wet for turnips.
2. Loam, in all its distinctions, fit for turnips.
3. Sand, including warrens and heaths, as well as rich sands.
4. Gravel, and flinty soils.
5. Chalk land, and Downs.
6. Peat, including moory, sedgy, rough bottoms, and fens.

As to the first class, comprehending all kinds of stiff clays ; a long course of observation has taught the writer of these pages, that when such soils have been many years in pasture, and are become well covered with good sorts of grass, affording a thick fine herbage, it can by no means be advisable to convert them into temporary tillage ; for it is impossible, with any system of management whatever, even with the aid of expensive manures, within any reasonable period, to bring such land to so good a turf as before it was ploughed.

There are instances innumerable in the South of England, of grass lands, separated only by a ditch or fence, where the old grass fields are worth from 10s. to 20s. per acre, more than those which have been lately in tillage ; although they have been laid down on well managed summer fallows with the best kinds of grass-seeds. The writer of this Essay has two fields of eight acres each on a stiff clay contiguous to each other, on a dead level, the soil in every respect the same ; one piece is supposed not to have been ploughed for centuries, the other was ploughed and laid down to grass about 30 years ago ; and although both have been stocked and managed precisely the same, yet the old grass is at this time worth more than double the other. To convert such lands therefore into tillage, with a view of returning them to pasture, would be an injury that no temporary advantage could recompense. But, as there are some situations, where, from local circumstances, old grass lands on these soils, however valuable as pasture, may be made more so to the proprietor, the tenant, and the public, by being converted into perpetual tillage ; it may not be improper here to digress a little from the subject of this Essay, and point out the best way of making such lands most productive and profitable.

The local circumstances before alluded to, which make such lands more valuable in tillage, than in grass, are their situation near great market towns, where the produce is easily removed, and where manure is always found in plenty ; or near sea-ports and navigable rivers, where there are similar advantages ; or in countries

where there is a superfluity of grass lands, and a scarcity of arable; by which means there is a better market for the produce of the latter than of the former.

The low price of labour is likewise a material consideration, and to this may be added the non-payment of tithe in kind, which is certainly a great inducement to convert grass lands into tillage.

The first step to be taken for this purpose is to drain the land, if it be wet, and then to analyze the soil. If it be found to contain no calcareous substance, which is frequently the case on stiff clays that have not been in tillage, it will be of infinite service to cover it with 60 cart loads, containing 30 bushels each, of chalk, or 100 of marl (one of which may probably be found in the neighbourhood) per acre, letting it lie spread on the turf one winter before it is ploughed in, and then by a summer fallow, ploughed from five to seven inches deep, according to the depth of the soil; the first year prepare it for wheat; which may be succeeded by beans in rows 18 inches apart, well hoed, and kept perfectly clean from weeds.

There are few such old grass lands, in a forward country, on stiff clay soils, but which, if converted into tillage in this way, and dunged once in four years, will produce good crops of wheat and beans alternately for several years. Four crops of straw, after being foddered out to cattle in a farm-yard, when converted into manure, and mixed with nearly an equal quantity of hedge or ditch mould, will produce compost enough to spread each time 50 or 60 good cart loads per acre; a quantity sufficient to keep the land perpetually in good heart.

If the land is not sufficiently fertile to bear wheat and beans alternately, or is in too backward a country to get the beans off, and the land clean in time to sow wheat, then one or other of the following rotations may be adopted, according to the judgment of the occupier:

1.	2.	3.	4.
Fallow.	Fallow.	Fallow.	Fallow.
Wheat.	Wheat.	Wheat.	Wheat.
Beans.	Beans.	Tares.	Clover.
Barley.	Oats.	Barley.	Wheat.

These are systems of four courses, the land returning the fifth year to fallow.

The crops of beans, tares, and clover may be varied the third year; as may the barley, oats, and wheat the fourth; but as these rotations are adapted for land

not likely to produce too much straw, the manure should always be laid on the fallow for the wheat crop.

There are other rotations of a greater number of courses that may, very properly, be followed on stiff clays, especially where manure is not very plentiful, or where it is required for other purposes; such as meadow lands, hop gardens, &c. The following are highly to be recommended, as being profitable, and keeping the land in good condition without exhausting it:

1.	2.	3.
Fallow.	Pease or oats on the turf.	Pease or oats.
Wheat.	Fallow.	Fallow.
Beans.	Wheat.	Wheat.
Barley or oats.	Clover.	Beans.
Clover.	Wheat.	Barley.
Wheat.	Beans.	Clover.
Fallow, &c.	Barley.	Wheat.
	Fallow, &c.	Fallow, &c.

In the first and third of these systems, the bean land should be dunged for barley, and in the second, the clover ley for wheat. The beans must be put in drills 18 or 20 inches apart, and twice or thrice both horse and hand-hoed, if practicable; each crop being carefully weeded. A dry season must be chosen on these stiff soils both for horse and hand-hoeing. Under either of these rotations of cropping, a plenty of manure will be found for once well dunging; which, with good management, will always keep the land in good order, and make it very productive. But as this is somewhat digressing from the main subject of this Essay, it is proper now to proceed to the second class of soils, *viz.*

2. Loam, in all its Distinctions, fit for Turnips.

This kind of land is a composition of argillaceous, silicious, and calcareous earth; the predominancy of either one or two of the three forming the different distinctions of loam; thus, if the argil abound, it is stiff loam; and if the silex abound, it is a gentle friable loam; and if calx or chalk abound, it is a chalky loam. Let the distinction of either kind of this soil be what it may, if it be tolerably dry, it is the best kind of land for turnips, and indeed for almost every sort of grain and herbage; but, like all other soils, is of infinitely more or less value according to

the skill and management of the occupier. The sandy loams are, however, the best for turnips.

If loamy soils, or lands of any description, are too wet either for grass or tillage, by means of an impenetrable subsoil, or a filtration of water from higher lands, or from springs from below, they should be drained by one or other of the means commonly adopted, according to circumstances, before ploughing, which leads to the subject of this Essay, *viz.* "the best means of converting this soil into tillage, without exhausting it, and returning it to grass, in an improved state, or at least without injury."

But before we proceed to this part of the subject, it is necessary to observe, that on these soils, as well as stiff clays, fine old pasture had better never be ploughed at all, as it is nearly impossible to bring them to so good a pasture as before ploughing; at least it is so in the southern part of England: how far the same causes may operate in the northern parts of this kingdom, or where there is a greater degree of humidity in the air, the writer of this is not a competent judge; but he believes that lands of every description are there more inclined to grass; and that the injury to pasture by tillage, and laying down to grass again, is not so great in the northern, as in these southern parts, where the air is more dry, and the soil subject to burn in dry summers.

There is a great quantity of grass land in all parts, on these as well as other soils, with a very indifferent turf from being foul with moss, weeds, bushes, and other rubbish; all such ought to be first recommended for tillage, in preference to breaking up fine old grass lands; because they will answer the full purpose of increasing the quantity of land in tillage, with the least injury to individuals, or the public.

But whether any of the distinctions of loamy soils be good or bad pasture, there is no way so expeditious and so profitable in bringing them into tillage, as by paring and burning:—expeditious, because the grass may continue being fed on till the paring commences in the end of April, and a full crop of turnips may be raised for the use of the following winter;—and profitable, because, after a crop of turnips eaten in the field by sheep continuing on it day and night, the land is left clean and full of manure, and in good order for a crop of barley or oats, which may be succeeded by clover, and then wheat; when, after the land has been refreshed by as much dung as the crops above mentioned have produced, another fine tilth is

made for turnips, to be eaten by sheep, continuing in the field as before. The land is thus left in a proper state to be converted into pasture, under a crop of barley, with as little injury as can be devised, and without robbing any other lands of the manure that is due to them; for by this system, no manure is carried to the land but what its own produce has made.

In all cases where the land is tolerably dry, (and where it is not so, as has been observed, it ought to be drained,) the turnips and clover should be eaten by sheep continuing upon it day and night, with a plentiful allowance of such fodder as can be obtained while eating turnips; by which a great abundance of manure is ready spread, making the land extremely fertile for the crops of corn, and keeping it in good heart for returning again to pasture, with the least possible injury from tillage.

Cattle, eating off turnips on the land, do not improve it so much as sheep, and to carry the turnips off is an irreparable injury to the soil. Cattle do great injury in wet weather by poaching the ground; and their manure, dropping in large lumps, is not so advantageously spread as that of sheep.

The best rotation of crops, then, to answer the purpose of a few years tillage on land to be returned to pasture with the least injury, is to pare and burn for,

Turnips,
Barley,
Clover,
Wheat,
Turnips,
Barley,
Pasture.

These soils should be ploughed only about four inches deep after burning for turnips, and then five inches for barley and wheat; after which, for the next crop of turnips six inches deep will bring up fresh mould, and the manure that has sunk with the rain filtering through the soil.

3. *Poor Sands, including Warrens and Heaths, as well as rich Sands.*

Poor sands and heaths are never covered with grass so as to be called good pasture; of course there can be no danger of making them worse by a few years tillage; such soils therefore, when corn is scarce and dear, as at present, should be the first to be resorted to for an additional supply.

Poor blowing sands, it is well known, have been improved from little or no value, to be worth from 1*cs.* to 20*s.* per acre, by coverings of clay and marl; and when so improved, have produced good turnips, carrots, rye-grass, and sometimes (if well clayed) barley, clover, and wheat. If after a few years tillage, the dung, that has arisen from the land by foddering out its produce to cattle in farm-yards, be spread on it for turnips, and those eaten upon it, as before recommended on loamy soils, this kind of poor land will be in a better state to be returned to pasture than before it was cultivated.

The best method to be adopted, when it is intended to till these poor sands, most of which are apt to blow or drift like snow, is, in the first instance, to destroy all the heath, furze, &c. on the surface by paring and burning, and then to give them tenacity by a thick covering of clay, which being finished with a good summer fallow, a fine crop of turnips may be expected. By folding these off with plenty of fodder, the soil is made very productive for several years to come, and one of the best rotations of cropping will then be,

Turnips,
Barley,
Clover,
Wheat;

as long as clay and manure can be obtained to keep the land firm and in good heart; but if, from the want of clay and manure, the soil is not sufficiently improved to bear clover, wheat cannot be expected, and must not be ventured upon; but the following rotation may be used instead. Pare and burn for,

Turnips,
Barley,
Rye-grass and trefoil two or three years,
Pease.

When these poor sands have been under one or two of either of these rotations, it is very proper to lay them down again to grass; but, in order that the best covering of turf may be produced, it is absolutely requisite that it should be done, as recommended on other soils, after a crop of turnips eaten off the land by sheep; the soil, being then clean from weeds and covered with the manure of the sheep, encourages the grass-seeds to come well, and get full possession of the land; which, when so managed, becomes a pasture infinitely more valuable than before it was

put into tillage. But it must here be observed, that the crops of corn should always be kept as clean as possible from weeds, so that no seeds of them be suffered to drop. The corn-marigold and poppy are very troublesome weeds on these sandy soils, and unless kept under, the land had better not be cultivated at all, for the weeds will frequently over-run the crop, and almost totally destroy it. The rich sands, which require a different treatment, are extremely valuable either in grass or tillage; when in grass, they are generally well covered with the best kinds, and produce a great abundance of a fattening quality both for oxen and sheep; when in tillage, they are easily cultivated, and, if kept clean from weeds, are very productive in all kinds of vegetables and corn.

There is hardly any distinction to be made between this land, and rich sandy loam; for there is no sand that can be rich without a mixture of clay, which gives it the denomination of loam; It may be proper here, therefore, to refer to what is said on the subject of loam, observing, that if it is determined to convert fine old pasture on this kind of land into tillage, "to return it after a certain period to grass in an improved state, or at least without injury," the best chance of doing so, would be first to pare and burn the surface early in the summer to ensure a crop of turnips, which ought to be sown before the first of July, and then to cultivate as before recommended, keeping the land perfectly clean from weeds, and returning it to pasture after a crop of turnips. Sandy soils, especially when intended to be returned to pasture, should be ploughed shallow, in order to keep as much of the clay and manure as near the surface as possible: five or six inches is full deep enough.

4. *Gravel and Flinty Soils.*

There are some lands on which nothing is to be seen but small round pebbles, and others, little else but craggy flints; which, if well covered with grass, should remain so, but otherwise may be converted into tillage.

As such soils cannot very well be pared for burning the surface, the best method would be to plough the turf in the winter, and either crop it with oats or pease the first year, or to make a fallow of it for wheat, and then proceed with one or other of the following rotations.

1.	2.
On the turf Oats or pease.	Fallow.
Fallow.	Wheat.

1.	2.
Wheat.	Turnip.
Turnips.	Barley.
Barley.	Clover.
Clover.	Pease.
Wheat.	Wheat.
Turnips.	Turnips.
Barley.	Barley.
Pasture.	Pasture.

These soils, when put into tillage, should be well mended with such manure as the country produces, and is best adapted to the land, which can only be known from local circumstances; thus, if the small quantity of earth found among the gravel or flints contains only clay or loam, then a certain quantity of lime or some calcareous substance is absolutely requisite; and if the mould be a composition of argillaceous and calcareous earth, then nothing is wanting but good dung, and hedge or other mould, which, with good cultivation, will make this land very productive. But on this, as well as most other soils, when the object is to bring it into tillage for a few years only, to be returned to pasture, the best rotation of cropping is as before recommended, *viz.*

Turnips.
Barley.
Clover.
Wheat.
Turnips.
Barley.
Pasture.

As it is very difficult to hoe turnips among flints, the seed may be sown very thin, with a mixture of cole seed, which will produce abundance of sheep-food without hoeing.

The barley or oats ought to be sown early, provided the land be tolerably dry, in order that the corn may get full possession of the ground before the dry weather sets in. These burning soils, especially the gravel, should always be ploughed seven or eight inches deep, that they may have a sufficient body of earth to retain a greater degree of moisture.

5. Chalk Land and Downs.

To convert grass land on this kind of soil into tillage, is one of the most advantageous improvements in agriculture, if properly conducted. Old Downs, that are frequently unproductive of any valuable herbage, may, in a very short space of time, and at little expense, be brought to yield the most abundant crops of corn ;— of barley, no land whatever produces better crops, nor finer samples, and when put under a proper system of tillage, good wheat may also be obtained.

The method is to pare and burn, in the first instance, a turf as thick as can be cut to burn well ; let the burning be finished as soon as possible in the spring, the ashes spread, and the land ploughed three or four inches deep ; harrowing and rolling it down smooth immediately after the plough to keep in the moisture. In the last week in June, let it be crossed ploughed about five inches deep, to mix the ashes intimately with the mould ; then sow the land with turnips, if a dry season by drilling, as that mode lets the seed down among the moist earth ; but if the season be rainy, sowing broad-cast will answer the purpose of a quick vegetation equally well. The drill system is, however, the best, as it gives a better opportunity of eradicating by the hoe, the seedling weeds, that on these old Downs are generally found ; particularly charlock, than which nothing is more pernicious. Every plant, that is left and seen in bloom among the turnips in the autumn, must be drawn out carefully by hand, as otherwise a little fine weather, in the early part of the winter, will ripen the seed, and a few frosty days after will shake it out on the land, where it will remain to vegetate in future, a plague to the farmer, and destruction to his crops. The turnips must be eaten off by sheep living upon the land night and day, having a quantity set out with hurdles, fresh for them as occasion may require, with a daily allowance of podware or trefoil straw for lean, and hay for fattening, sheep. Some fodder is absolutely necessary, as turnips alone, especially in wet weather, are very unwholesome. To fatten sheep on turnips with oil-cake is the greatest improvement, and, however the farmer may be, in some respects, a loser by feeding sheep in this way, his loss will certainly be repaid ten-fold in his future crops of corn. Instances can be brought in proof to the Board of Agriculture, if thought necessary, of crops of corn being raised by this means to be worth sixty times the annual rent of the land. After the turnips are consumed, the land should be ploughed about four inches deep as speedily as possible, and sown with

barley, and clover-seed, the sooner after the month of January, provided the land be not very wet at the time of sowing, the more valuable in general will be the produce. Every weed that is seen among the barley must be taken out by hand; and if the cultivator has any reason to suppose, that there is a great abundance of the seeds of weeds remaining in the soil after the first crop of turnips, a second should be raised the following summer, in order to get the land completely clean before he ventures upon crops of corn.

The crop of clover should be eaten off by sheep lying upon the land, and, if it can be accomplished, the ley may be folded in the end of summer, ploughing it afterwards five inches deep, to be sown with wheat in the month of October, or early in November. Every weed found among the wheat in the month of June, and early in July, should be carefully taken out by hand; and, as soon as convenient after harvest, the land should be ploughed about five or six inches deep. The land, having by this rotation produced two stout crops of corn, is entitled to a portion of manure equal to what has arisen from it, which, mixed with mould as before directed, will afford a tolerable covering for another crop of turnips. These being eaten in the field as before, the land is left in fine order to accomplish the object required by the Honourable Board of Agriculture, *viz.* "returning to grass without injury;" indeed so far from injury, these soils will, on the contrary, be highly improved, for every kind of grass, but more particularly for sainfoin; abundant crops of which have frequently been raised under this management, on lands of this description, by the writer of this Essay.

6. *Peat, including moory, sedgy, rough Bottoms, and Fens.*

These kinds of land are seldom or ever seen covered with fine pasturage, and, therefore, the hazard is little of making them worse by tillage; in fact, like old Downs, they ought to be converted into tillage, as one of the means of making them better, and more valuable when returned to grass.

The first thing to be done is to drain the surface, otherwise tillage would be entirely useless, and attended with great loss; for no expense of manure and tillage will avail any thing while the surface is saturated with water.

The mode of performing this operation varies with circumstances; if the soil be a complete peat several feet deep, it is a mass of vegetable matter in a state of perpetual increase from the annual decay of a portion of the aquatic plants, of which

it is composed. The pabulum, or food, of this mass being water, if it be deprived of that, the vegetation of course ceases, and in place of its continuing a mass of live vegetable matter, it becomes a bed of rich vegetable mould, or in other words, a rotten dunghill ; fit, with proper management, either for tillage or pasture.

The water, that is the food and cause of peat, has its source in extensive lands of a higher level ; hence it is obvious, that if a deep trench, or ditch, be cut at the foot of the hilly country, a little above the upper part of the bog, and the trench bored, as pointed out by Mr. Elkington, to bring the water from the springs into the trench, to be from thence conveyed away to a lower level, the mischief will be cut off from its source, and the bog effectually drained.

Moory and sedgy soils, with rough bottoms and fens, have frequently a stiff tenacious subsoil of clay that holds water like a basin, and the surface is a covering of moory or peaty soil, from a few inches to some feet in thickness ; this is generally occasioned by the situation being so low, that there is not a sufficient conveyance for the water, that comes down from the adjacent country, to pass away ; so that it remains on the surface generally all the winter, and frequently some weeks in the summer, until dispersed, partly by the usual ineffectual modes of drainage, and partly by evaporation ; leaving a moory sedgy surface of little value either for tillage or pasture.

To drain this kind of land, it should be embanked around the outside above the level of the highest known floods, and by windmill pumps, or other machinery (if there be not a sufficient outfall) to lift the superfluous water, that falls by rain on the land, into the drains or sewers. These are the outlines of draining these kinds of land ; to particularise it farther would be digressing from the subject ; it is requisite, therefore, to proceed and point out the best way of cultivating this land, as required by the Honourable Board, to make it fit for " returning to pasture with the least injury."

After draining these moory rough sedgy soils, the next thing is to pare and burn the surface, and then to till them as directed for old Downs ; but sowing cole-seed instead of turnips, and feeding it in dry weather on the land with plenty of fodder. If a return soon to grass be the principal object, one crop of oats may succeed the cole-seed ; and after a second crop of cole-seed eaten on the land as before, it will then be in fine order to sow with grass-seeds among the second crop of oats.

But if tillage a few years longer be the object, a good covering of lime, marl, or

chalk, will make this kind of soil extremely fertile and valuable. The abundant crops of oats, that are produced in two or three years in succession in the fens, are striking proofs of the fertility of these soils; for nothing can be more ruinous and exhausting than such repetitions of oats after oats.

The writer of this Essay had a small piece of osiers on land of this nature, which being dug up, and the land drained, well limed, and some of it pared and burned, has since produced abundant crops of potatoes, kidney-beans, canary-seed, beans, and wheat. The common beans were above seven feet high.

The following rotations of cropping are highly to be recommended, after draining, on these soils; after which, it is needless to say, they will be returned to pasture in an improved state.

1.	2.	3.
Cole-seed.	Cole-seed.	Cole-seed.
Oats.	Oats.	Oats dunged for
Cole-seed.	Beans dunged for	Potatoes.
Oats.	Potatoes.	Wheat.
Pasture.	Wheat.	Cole-seed.
	Cole-seed.	Oats.
	Oats.	Pasture.
	Pasture.	

Having thus far pointed out the general system of management for the various kinds of soils, that are meant to be kept a few years only in tillage, down to the concluding crop with which the grass-seeds ought to be sown; it remains to show how much of the several sorts of seeds are necessary to produce the best pasture.

As good sorts of grass-seeds are never to be purchased, they must be saved before hand by the person who has occasion to use them.

The best that can be obtained are those that can be had from an old pasture, meadow, or marsh, that is known to abound in good kinds of grass; taking care that the soil, from which the seed is to be saved, is similar to that on which it is to be sown, for this is following nature, the husbandman's best guide. The field being selected, instead of cutting the grass at the usual time for hay, let it stand until the yellow oat-grass begins to turn yellow; by which, as it is one of the latest sorts, all the others will be come to perfection; it may then be mown, and, when fully

ripe, thrashed out on a sail-cloth in the field, or carried into the barn to be thrashed in winter; if thrashed in the field, the straw may be stacked as bay, which will make good fodder for lean cattle.

About four bushels of this seed, after being sifted through a sieve of 12 wires to the inch, with 8 lbs. of rib-grass, 4 lbs. of white Dutch clover, and 4 lbs. of cow-grass-seeds, will be sufficient for an acre of land. On chalky, and all dry soils, however, 4 lbs. of yellow trefoil-seed per acre should be added.

The seeds should be sown immediately after the corn in the spring, when the land, with harrowing and rolling, should be well pulverised, and left perfectly smooth.

If a good pasture be the grand object, without any view to the profit of the last crop of corn, the grass-seeds may be sown on a well made summer fallow, about Midsummer, as soon as the seed is thrashed; after the seeds are well harrowed in, the land should be repeatedly rolled, to make it even for future mowings.

If the tenant has a lease, or a certainty of enjoying the produce for a term of years, he certainly ought to provide the seeds for laying the land down to grass again; but if he has not that advantage, he will hardly give himself the trouble, and put himself to the expense of preparing his land to lay down to permanent pasture.

The first year, new made pastures should be lightly fed with young cattle, in order that the plants of grass may get strength, by which many plants will run to seed, and, dropping on the land, will thicken the turf the second summer, when it may be hard stocked with sheep, or mown for hay. If it can be folded or dunged, it will tend greatly to strengthen and improve the turf.

There appears to be no general principle by which an increase of rent can be estimated, for permission to break up old pasture under lease. This can only be properly ascertained by intelligent, and disinterested persons in the neighbourhood, acquainted with the local circumstances of the case; who, by an actual survey, be enabled to decide on, and apportion the several interests of the parties.

No. XIV.

An Account of the Methods of converting Grass Lands into Tillage, and of returning them to Grass again after a certain Period, (with some general Observations,) practised by Mr. William Greenall, of Eceleston, near Prescott, Lancashire.

THE Committee of the House of Lords having required the Board of Agriculture to examine into and report to their Lordships, "The best means of converting certain "portions of grass lands into tillage, without exhausting the soil, and of returning the "same to grass, after a certain period, in an improved state, or at least without injury," and the Board having advertised for useful information on the subject, I beg to offer the following, acquired by observations, and actual experiments I have made and practised on a variety of soils, to improve the land, and to pay me in my business as a farmer.

In the following statements, I shall necessarily reply to some of the particulars required by the Board of Agriculture; and such as I have any knowledge of, that I do not touch upon, I will endeavour to reply to in general terms afterwards; and as it is required to detail the experiments, course of crops, &c. perhaps I may be too prolix, which will arise from a desire of giving any information that may be herein, as full as possible.

AT Candlemas, 1783, I made an addition to my old farm, by taking upon lease for fourteen years, a considerable quantity of grass land, (pasture and meadow,) which consisted of a variety of sorts of soils. Having observed that manuring it on the grass had nearly lost its effect, and that land (like the appetite of man) becomes satiated by a continuance of the same thing, and will not answer so well to a repetition of the same manures, nor bear the same sort of crop so well as if changed now and then, I therefore broke it up; and the management and experiments I will give in detail, under the different denominations of soils I had to practise upon.

First. On Sandy Soils.

Experiment I. was on a field of 24 statute acres of a light sandy soil, lying upon red rock, on the declivity of a hill which had lain as pasture time immemorial, it being very thin of soil, and the rock near the surface; but the rock being of a soft slaty nature, with four strong horses, an iron plough, and much trouble, I succeeded in ploughing it, by the middle of March, 1783. The pieces of rock and the stones that were turned up by ploughing, I gathered and carried off; and in May following, I had it cross ploughed, and very well harrowed.

From a bed of marl, (in the valley,) at about 300 yards distance from the bottom of the field, I put about $2\frac{1}{2}$ roods of 8 cubic, or 64 yards to the rood, of strong clayey marl, (in the months of June and July,) upon every statute acre, which I had equally spread, and then knocked into small pieces, and the stones gathered out, and carried off. Early in September following I had it ploughed again, and found the land in very good condition to receive the seed, as the marl, by effectually covering the land upwards of an inch thick, * had created a considerable fermentation, and the sods were perfectly rotten; but as the marl and soil were not much mixed, and the marl being thrown under, I gave it another ploughing to mix it, and to throw the marl as near the top as possible, that it might receive the benefit of the frosts and weather. I then sowed it with wheat, which I harrowed in. The wheat produced a crop averaging near $38\frac{1}{2}$ bushels of 70 lbs. each, on a statute acre; near 43 Winchester bushels.

In November, after harvest in 1784, I had it ploughed and laid as open as possible, that it might receive the benefit of the winter, to make it incorporate and mix freely together. In March, 1785, I had it cross ploughed and well harrowed, and put upon it about a rood of compost of eight cubic yards to every statute acre. The compost consisted of soaper's waste, and strong loamy soil, proportioned about one ton of soap-waste, to four tons of soil, got by cleaning ditches and gutters, and from useless banks in the lands adjoining in the valley; I then ploughed it and sowed on it barley and red clover.

* A rood of marl of 8 cubic yards will cover a statute acre of land 0.476 inch, or nearly half an inch thick. A statute acre contains 6,272,646 superficial inches on its surface, and a rood of marl of the above dimensions 2,985,984 inches of an inch thick.

The produce of the barley was 57½ bushels Winchester measure to a statute acre; and the clover (being mown twice in 1786,) produced upwards of five tons to the statute acre.

In November, 1786, I ploughed it and laid it open as before, as I intended to lay it down to grass again. In March, 1787, I gave it two ploughings, and a light dressing with compost, consisting of dung and earth, proportioned about two tons of dung to three tons of earth, got from useless banks in the field, which was harrowed in with the seed-oats, grass-seeds, white clover, trefoil, and rye-grass. The oats produced a crop averaging 47 bushels of 45 lbs. each, or 57 Winchester bushels per statute acre, and the grass-seeds, being mown the year following, produced upwards of two tons of hay in every statute acre. As soon as I had got the hay, I gave it a dressing with compost, and have continued to do so every three years, changing every time the sort and consistence of the compost; and since then it has lain as a meadow, averaging an annual produce of near two tons to the statute acre of a very good kind of hay.

Too much attention cannot be paid to the management of compost in its several stages and operations; but I will endeavour to explain this more fully herein afterwards.

The following account, copied from my books, will shew the expenses of the above management, and also the account of the produce, until it was laid down to grass again.

Dr. Part of New Farm, 24 Acres.			Hill-Field.			Cr.		
	£.	s. d.		£.	s. d.			
1783.			1784.					
Mar. 18. To ploughing 30 days, at 10s 6d per day	15	15 0	Feb. 2. By amount carried down to the debit side	353	6 11			
20. To four women gathering stones, 10 days each, at 8d. per day	1	6 8						
21. To team of 2 horses, 2 days carting stones off, at 5s. 6d. per day	0	11 0						
April 29. To ploughing 24 days, at 7s. 6d. per day	9	0 0						
June 9. To harrowing 16 days, at 7s. 6d. per day	6	0 0						
12. To soughing marl-pit dry	3	11 4						
Amount carried forward	£ 36	4 0						

Dr.	Part of New Farm, 24 Acres.		Hill-Field.	Cr.
		£. s. d.		£. s. d.
	To amount brought forward	36 4 0	1784. Feb. 2. By amount carried to the debit side	353 6 11
18.	To feighing marl-pit, 12 roods, at 9s. per rood	5 8 0		
July 23.	To filling 58 roods of marl, at 10s. 6d. per rood	30 9 0		
	To carting ditto, at 52s. 6d. per rood	152 5 0		
	To spreading ditto, at 2s. 7d. per rood	7 9 10		
	To knocking about ditto, and picking stones, at 1s. 6d. per rood	4 7 0		
Aug. 1.	To carting stones 2 days, at 5s. 6d. per day	0 11 0		
Sept. 3.	To ploughing 24 days, at 7s. 6d. per day	9 0 0		
29.	To half year's rent	33 0 0		
Oct. 1.	To ploughing 24 days, at 7s. 6d. per day	9 0 0		
	To 48 bushels of seed wheat, at 7s. 6d. per bushel	18 0 0		
	To harrowing and finishing, 17 days, at 7s. 6d. per day	6 7 6		
	To guttering and fencing	2 3 2		
1784. Feb. 2.	To half year's rent	33 0 0		
	Proportion of taxes	6 2 5		
		<u>£ 353 6 11</u>		<u>£ 353 6 11</u>
	To amount brought down	353 6 11		
Mar. 5.	To paid for fencing	0 3 0	1784. Dec. 25. By 933½ bushels of wheat, at 7s. per bushel	326 12 9
Sept. 1.	To reaping wheat, at 4s. per acre	4 16 0	By 62½ ditto light ditto, at 3s. 6d. per bushel	10 17 0
	To allowance for liquor	0 10 6	By 30 loads of straw, at 21s. per load	31 10 0
	To housing and expenses	4 17 5		
29.	To half year's rent	33 0 0	1785. Feb. 2. By balance carried down to debit side	116 17 6
Dec. 1.	To ploughing 24 days	9 0 0		
1785. Feb. 2.	To half year's rent	33 0 0		
	To proportion of taxes	5 3 8		
	To thrashing 996 measures of wheat, at 4½d. per meas.	18 13 6		
	To carting straw, and marketing	5 3 3		
	To interest on £363, one year	18 3 0		
		<u>£ 485 17 3</u>		<u>£ 485 17 3</u>

Dr. Part of New Farm, 24 Acres.				Hill Field.			
1785.				1785.			
	To balance brought down	£.	s. d.			£.	s. d.
Mar. 15.	To ploughing 24 days, at 7s. 6d. per day	9	0 0	Dec. 20.	By 1221 bushels of barley, at 4s. 6d. per bushel	275	4 6
	To 100 tons of soap-waste, and carting, at 12s. per ton	60	0 0		By 47 ditto ditto, at 2s. 6d. per bushel	5	17 6
	To 20 bushels of lime, and ditto, at 8d. per bushel	0	13 4		By 750 thraves of straw, at 8d. per thrave	25	0 0
	To 4 men, each 25 days, at compost, at 1s. 6d. per day	7	10 0		By balance carried down to debit side	27	1 5
	To carting compost	12	10 0				
	To filling and spreading do.	6	3 3				
April 4.	To 50 bushels of seed-barley, at 3s. 9d. per bushel	9	7 6				
	To 250lbs. of red clover, at 6d. per lb.	6	5 0				
	To harrowing and finishing, 14 days, at 5s. 6d. per day	3	17 0				
	To guttering, fencing, &c.	1	4 4				
Aug. 14.	To reaping barley, and expenses	5	1 8				
21.	To housing, and expenses	3	2 1				
Sept. 29.	To half year's rent	33	0 0				
1786.							
Feb. 2.	To ditto ditto	33	0 0				
	To proportion of taxes	4	7 7				
	To thrashing 1268 bushels of barley, at 2½d. per bushel	13	3 2				
	To carting, and marketing	2	5 0				
	To 1 year's interest on £116.	5	16 0				
		£333	3 5			£333	3 5
				1787.			
July 1.	To balance brought down	27	1 5	Feb. 2.	By 127 tons of hay sold, at £3 10s. per ton	444	10 0
	To paid for mowing clover, and liquor	3	0 0				
	To hay-makers, housing, &c.	4	7 1				
Sept. 1.	To mowing second crop, and liquor	3	0 0				
	To hay-makers, housing, &c.	4	2 5				
29.	To half year's rent	33	0 0				
Nov. 28.	To ploughing 24 days, at 7s. 6d. per day	9	0 0				
1787.							
Feb. 2.	To half year's rent	33	0 0				
	To proportion of taxes	6	18 3				
	To cartages and expenses	10	1 3				
	To 1 year's interest on £27	1	7 0				
	To balance carried to Cr. side	309	12 7				
		£444	10 0			£444	10 0

Dr.	Part of New Farm, 24 Acres.		Hill-Field.	Cr.
1787.		£. s. d.	1788.	£. s. d.
Mar. 29.	To ploughing 48 days, at 7s. 6d. per day	18 0 0	By balance per Dr. side	309 12 7
	To 500 loads of compost, at 2s. 6d. per load	62 10 0	Feb. 2. By 1133 bushels of oats, at 2s. 10d. per bushel	160 10 2
	To filling, carting, and spreading ditto	14 7 6	By 497 thraves of straw, at 8d. per thrave	16 11 4
	To 120 measures of seed oats, at 2s. 9d. per meas.	16 10 0	By one year's interest on £309	15 9 0
	To 360 lbs. of seeds	15 0 0		502 3 1
	To harrowing, sowing, and finishing	7 1 2	From debit side	235 5 2½
Aug. 20.	To reaping and housing oats, &c.	12 7 7	Profit at the end of five years	£266 17 10½
Sept. 29.	To half year's rent	33 0 0		
1788.				
Feb. 2.	To ditto ditto	33 0 0		
	To proportion of taxes	7 3 1		
	To thrashing 1133 bushels of oats, at 1½d. per bushel	7 1 7½		
	To carting and expenses	9 4 3		
		<u>£235 5 2½</u>		

Experiment II. was on a field of 10 statute acres, adjoining the before-mentioned, the same in respect to soil, situation, &c. which (previous to marling) was managed the same, and marled at the same time as the other; but as soon as marled, was sown with turnips, which produced a crop nearly averaging 351 bushels to the statute acre, which I had pulled and carried off, as eating them on the ground was not much practised in this county (Lancashire). In the spring, 1784, I planted it with potatoes in drills, made by the plough, two feet asunder, and put upon every statute acre about 20 tons of dung. The potatoes produced a crop of 347 bushels to every acre, and in October they were gotten up, and the land ploughed and sown with wheat, which produced a crop in 1785, averaging 37½ bushels, of 70 lbs. each, or 41½ Winchester bushels to the statute acre. After the harvest in 1785 I had it ploughed, and laid as open as possible; and in March 1786 ploughed it again, and put upon it about the same quantity and sort of compost per acre, as I had done on the other field the preceding year, viz. compost consisting of soap-waste and strong loamy soil, which I ploughed in, and then sowed the land with barley, grass-seeds, white clover, trefoil, and rye-grass. The barley produced a crop, averaging 57 bushels, of 60 lbs. each, or 63 Winchester

bushels to the statute acre ; and the grass-seeds, being mown in 1787, produced near $2\frac{1}{2}$ tons per statute acre. Since then the field, has lain as a meadow, and has been managed in every respect as the other ; and the annual produce per acre has been as near the same as possible.

The following account from my books will shew the expenses of this method of management, and the produce of this course of crops until it was laid down to grass in 1787. For the sake of brevity, I will proportion the expenses, till after it was marled, from the other account, as they were exactly the same per acre.

Dr. Part of New Farm, 10 Acres.				Nearer Hill Field. Cr.			
1783.		£.	s. d.	1783.		£.	s. d.
July 1.	To ploughing, marling, &c.			Dec. 26.	By 3516 bushels of turnips, at 6d. per bushel	87	18 0
	to this day -	98	7 3		By balance carried to Dr. side - - -	64	10 3
	To 12 lbs. of turnip seed, at 8d. per lb.	0	8 0				
	To sowing, harrowing, and finishing -		2 7 0				
Aug. 10.	To hoeing turnips -		2 2 0				
Sept. 12.	To ditto ditto -		2 2 0				
29.	To half year's rent -	13	15 0				
Dec. 18.	To pulling turnips and cutting tops -		5 16 8				
	To carting off, and expenses -	11	4 4				
1784.							
Feb. 2.	To half year's rent -	13	15 0				
	To proportion of taxes -	2	11 0				
		£ 152	8 3			£ 152	8 3
	To balance carried forward	64	10 3				

Dr. Part of New Farm, 10 Acres.			Nearer Hill Field.			Cr.		
		£. s. d.				£. s. d.		
1784.			1784.					
Feb. 2.	To balance brought forward	64 10 3	Nov. 4.	By 3298 bushels of potatoes, at 1s. 6d. per bushel	247 7 0			
Mar. 25.	To ploughing 10 days, at 7s. 6d. per day	3 15 0		By 174 ditto, at 1s. per bushel	8 14 0			
Apr. 12.	To harrowing four days, at 7s. 6d. per day	1 10 0		By 40 measures of turnips	1 10 0			
	20. To ploughing eight days, at 7s. 6d. per day	3 0 0						
May 1.	To 200 tons of dung, and carting, at 7s. per ton	70 0 0						
	To spreading ditto	0 15 0						
	To 150 bushels of potatoes, at 2s. per bushel	15 0 0						
	To cutting ditto, at 3d. per bushel	1 17 6						
	To planting ditto, at 1d. per bushel	0 12 6						
	To five days ploughing to cover ditto	1 7 6						
	To guttering and finishing	1 2 3						
June 10.	To ploughing among potatoes	1 7 6						
July 21.	To ditto ditto	1 7 6						
	To hand-weeding ditto	0 10 6						
	To 2 lbs. turnip-seed for head-lands	0 1 4						
Sept. 29.	To half year's rent	13 15 0						
Oct. 10.	To getting 3472 bushels of potatoes, at 2d. per bushel	28 18 4						
	To carting and expenses	6 7 0						
13.	To ploughing 10 days	3 15 0						
	To 20 bushels of seed-wheat	7 0 0						
	To harrowing five days	1 7 6						
	To sowing, fencing, and finishing	1 3 1						
1785.								
Feb. 2.	To half year's rent	13 15 0						
	To proportion of taxes	2 2 10						
	To one year's interest on £64	3 4 0						
	To balance carried to Cr. side	9 6 5						
		<u>£ 257 11 0</u>					<u>£ 257 11 0</u>	
Aug. 20.	To reaping wheat	2 10 0	1785.					
	To housing and expenses	3 1 3	Feb. 2.	By balance per Dr. side	9 6 5			
Sept. 29.	To half year's rent	13 15 0	1786.					
Oct. 27.	To ploughing 10 days	3 15 0	Feb. 2.	By 3461½ bushels of wheat, at 6s. 9d. per bushel	116 18 6			
1786.				By 23½ ditto, at 3s. 6d. per bushel	4 2 6			
Feb. 2.	To half year's rent	13 15 0		By 15 loads of straw, at 11s. per load	15 15 0			
	To proportion of taxes	1 10 6		By interest on £9	0 9 0			
	To thrashing 176 bushels of wheat, at 4½d. per bushel	7 1 0						
	To carting and expenses	2 3 1						
	To balance carried to Cr. side	98 14 7						
		<u>£ 146 11 5</u>					<u>£ 146 11 5</u>	

Dr.	Part of New Farm, 10 Acres.		Nearer Hill Field.	Cr.	
1786.		£. s. d.	1787.	£. s. d.	
Mar. 10.	To ploughing 10 days	3 15 0	Feb. 1.	By balance per Dr. side	98 14 7
	To 11 roods of compost, at 60s. per rood	33 0 0	Feb. 2.	By 542 bushels of barley, at 4s. 6d. per bushel	122 19 0
	To carting and spreading ditto, at 15s. per rood	8 5 0		By 30 ditto ditto, at 2s. 6d. per bushel	3 15 0
25.	To ploughing 10 days	3 15 0		By 357 thraves of straw, at 7d. per thrave	10 8 3
April 4.	To 20 bushels of seed-barley	3 10 0		By interest on £89	4 9 0
	To grass-seeds	3 15 0			
	To harrowing and sowing	1 10 0			
	To guttering and finishing	0 18 2			
Aug. 14.	To reaping barley	2 5 0			
25.	To housing and expenses	2 11 4			
Sept. 29.	To half year's rent	13 15 0			
1787.					
Feb. 2.	To ditto ditto	13 15 0			
	To proportion of taxes	2 17 6			
	To thrashing 572 bushels of barley, at 2½d. per bushel	5 10 10			
	To carting and expenses	1 10 0			
	To balance carried to Cr. side	139 13 0			
		£ 240 5 10			£ 240 5 10
			1787.		
			Feb. 2.	By balance, profit at the end of four years	£ 139 13 0

In the foregoing accounts, the prices of labour, produce, &c. are as they were in the respective years in which the business was done; but a comparative statement may be easily drawn. It may be also necessary to remark, the expenses of the marling are more than common, on account of the distance and carting it up hill. In common, two horses to a cart will go from the pit, 90 yards, and return, while four men fill a cart for them; and three horses will go 115 yards, and return, while the same number of men fill a cart for them.

Marl-pits should be made on the highest ground, not only on account of carting down hill, but that they may be laid dry by soughs, and the land made good again. If they are not laid dry, they destroy a great deal of land; and, if they are on high ground, they serve as reservoirs to make the land below continually wet, by the water draining through the stratum that generally lies between the marl and soil.

By Experiment I. it appears that 24 acres of land produced four crops in five years, amounting to £1312. 2s. 3d. and that the rent, management, &c. amounted to £1045. 4s. 4d. leaving a profit of £266. 17s. 11d.; or, one statute acre

averaged an annual produce amounting to £11. 2s. 5d. and an annual profit of £2. 4s. 6d.

And, by Experiment II. it appears that 10 acres of land, of the same sort in every respect, produced four crops in four years, amounting to £624. 5s. 3d. and the expenses of management, rent, &c. amounted to £484. 12s. 3d. leaving a profit of £139. 13s. 0d.; or, one statute acre averaged an annual produce amounting to £13. 19s. 0d. and an annual profit of £3. 9s. 9d. which leaves the result decidedly in favour of the course of crops, method of management, &c. practised in Experiment II. as the land is as much improved, and left in equally good condition. It also shews, that in breaking up grass lands, fallowing should not be practised.

Experiment III. A field of eight statute acres (lying adjoining the before mentioned, on the summit of the hill) of the same nature of soil, but deeper and richer, I ploughed in February 1788; and marl being at too great a distance, I collected a large quantity of strong loamy soil, mud, &c. which I made into compost with soap-waste and lime, proportioned about one ton of soap-waste, four tons of soil, &c. and 20 measures of lime, of which, in March, I put about one rood and a half (of eight cubic yards to the rood) upon every statute acre, and harrowed it in along with the seed-oats. The oats produced a crop averaging near 43 bushels of 45 lbs. or $54\frac{1}{2}$ Winchester bushels to a statute acre. In spring 1789 I ploughed it, and prepared it for potatoes, with which I planted it, in drills two feet asunder, by the plough, putting on every statute acre about 20 tons of dung, which produced a crop averaging 353 bushels, of 90 lbs. each, to the acre. As soon as the potatoes were gotten up in October, I had the field ploughed, and sown with wheat, which produced, in 1790, upwards of $38\frac{1}{2}$ bushels, of 70 lbs. each, or $43\frac{1}{2}$ Winchester bushels to an acre. In November I had it ploughed, and again in the spring 1791, and put upon it a good dressing of compost, consisting of soil (got from useless banks in the field,) dung, soap-waste, and a small quantity of lime, proportioned about four tons of soil, one ton of dung, one ton of soap-waste, and about two measures of lime: the lime was put in merely to increase the fermentation in the compost during its several operations. This compost was harrowed in along with the seed-barley, grass-seeds, white clover, trefoil, and rye-grass. The barley produced on every statute acre 48 bushels, of 60 lbs. each, or 53 Winchester bushels, and the

grass-seeds on the same quantity of land, (being mown in 1793,) near two tons of hay.

By this method of management the field is considerably improved, though not near so much as if it had been marled, as it requires manure every two years to keep up with the other fields in quantity of hay.

As the expenses of management have been particularised in the preceding accounts, I presume it will be sufficient briefly to state, that in four years this field produced four crops of the value of £429. 9s. that the rent, expenses of management, &c. amounted to £315. 5s. 2d. and that the profit amounted to £109. 3s. 10d.; or, the produce of one statute acre annually averaged £14. 5s. 5d. and a profit of £3. 11s. 4d. It may be necessary to remark, that the prices of produce in the years this experiment was made in, were near one-tenth more than in the former years; therefore, in comparing the profits, one-tenth should be deducted from this statement, as the prices of labour, manure, &c. were nearly the same.

In February 1787, I ploughed a meadow of a deep, rich, sandy soil, that had been under irrigation a great number of years, which, perhaps by injudicious management, was grown full of rushes and very sour grass, and I was much surprised to find that the oats were very full of weeds, which injured the crop. The water from a brook was brought in a direction, so as that it could be turned over the land at pleasure, and it struck me that the water, in filtering through the grass, had left the seeds collected in its course among it, and by ploughing the land they had vegetated.

A field adjoining, of the same nature of soil, and under the same management, I ploughed the year after; part, as before, was weedy; the other part I had pared and burned before it was ploughed, and the crop was perfectly clean, which convinced me that I was right in my conjectures in respect to the cause of the weeds. In the first crop the pared and burned part was about one-fourth part better crop, but afterwards there was no perceptible difference.

I marled both fields after the crop of oats, and then managed and cropped them as in Experiment II. and the result was upwards of £15. *per cent.* more produce and profit, as the land is naturally of a better quality. After the first year's mowing, when the land was laid down to grass again, I turned the water over it again, and the hay is very much improved, both in quantity and quality.

Being the farmer of the corn tithes of a district, where agriculture and the improvement of land is much encouraged and practised, (which I have annually surveyed and valued, and gathered in kind,) I have been enabled to make accurate observations on a variety of methods of management and routine of crops; and by comparing the produce, probable profit, and condition of the land when laid down to grass again, I have found the plan I have pursued to have a decided preference in every respect to any, practised by my neighbours, that has varied from mine. In breaking up grass lands of a sandy soil, I have invariably pursued the method of management, and course of crops, as in Experiment II. where marl could be had that would not cost more than £10. per statute acre; but where it could not, I have practised as per Experiment III. and always with success, never ploughing the land I intended to lay down to grass again, for more than four crops, as I have found that keeping the land longer under tillage reduces the quality of the land for grass, and makes it more subject to weeds, and to lose its natural kind of grass.

It may appear unnecessary to manure lands that have been well manured on the grass, before they have borne one crop, after ploughing, but I have always found it to repay me, and I think it is the foundation of the subsequent improvement and profit.

Secondly. On Clays.

A field of nine acres, of a strong clayey soil, had lain as pasture many years. I broke it up in November 1789, (by ploughing it a strong furrow,) with an *intent* to lay it down to grass again as soon as it was improved; and I managed it as follows:

In the spring 1790, I gave it a very good dressing with compost of dung and brook or river-sand, with a little lime, proportioned about two tons of dung, two tons of brook-sand got by cleaning water-courses, and five measures of lime, which I harrowed in along with the seed-oats, which produced a crop averaging 53 bushels, of 45 lbs. each, per statute acre, or 64 Winchester bushels. I ploughed it in November, after getting the oats, and again the spring following; when I put upon it a good dressing of compost, consisting of soap-waste, dung, and peat-earth, proportioned about one ton of soap-waste, two tons of dung, and three tons of peat-earth, and as much lime as would create a fermentation. It was equally spread, and then I drilled the land with a drill plough, in drills nine

inches asunder, and in them laid beans about four inches distance from each other, and covered them with a light harrow; they produced a crop averaging 41 bushels to the statute acre. As soon as the beans were housed, I ploughed the land again, and sowed it with wheat, which produced a crop averaging 41 bushels, of 70 lbs. each, or 48 Winchester bushels to the statute acre. I ploughed it as soon as the wheat was got, and again the spring following, and gave it a light dressing of the same sort of compost as the last-mentioned, which I harrowed in along with the seed-oats, grass-seeds, white clover, and trefoil. The produce of the oats was near 52 bushels, of 45 lbs. each, to the statute acre, or 63 Winchester bushels; and it has lain as pasture since, very much improved indeed, producing a much better quality of grass, and the sward is of a more firm and tough texture.

The following particular account of this field, while under tillage, is copied from my books, which will shew the amount of rent, expenses, &c. and also the amount of produce, profit, &c. until it was laid down to grass again.

Dr.			Barn Pasture, Nine Acres.			Cr.		
1789.			£. s. d.			1791.		
Nov. 20.	To ploughing 12 days, at 7s. 6d. per day		4	10	0	Feb. 2.	By 444 measures of oats, at 3s. 6d. per measure	77 14 0
1790.							By 33 do. do. at 1s. 8d. per measure	2 14 6
Mar. 1.	To 115 tons of dung, at 6s. per ton		34	10	0		By 203 thraves of straw, at 1s. per thrave	10 3 0
	To filling and carting sand		7	1	2		By balance carried to Dr. side	18 8 2½
	To 285 bushels of lime, and carting, at 8d. per bushel		9	10	0			
	To making compost, and attendance		3	15	1			
	To filling, carting, and spreading ditto		6	11	4			
18.	To 45 bushels of seed-oats, at 3s. 6d. per bushel		7	17	6			
	To harrowing, guttering, and finishing		1	3	4			
Sept. 29.	To half year's rent		12	7	6			
	To reaping oats, and expenses		2	2	0			
	To housing ditto, and ditto		1	3	9			
1791.								
Feb. 2.	To half year's rent		12	7	6			
	To proportion of taxes		2	5	4			
	To thrashing 477 bushels of oats, at 1½d. per bushel		2	19	7½			
	To carting and expenses		0	15	7			
			£ 108	19	8½			£ 108 19 8½

Dr.			Barn Pasture, Nine Acres.	Cr.		
		£. s. d.			£. s. d.	
1793-				1794-		
Mar. 1.	To ploughing nine days	3 7 6		By balance	56 17 5	
	To 110 tons of compost, carting, &c.	33 0 0		Feb. 2. By 438 bushels of oats, at 3s. 6d. per bushel	76 13 0	
	To 45 measures of oats	8 15 0		By 25 ditto, at 1s. 6d. per bushel	1 17 6	
	To grass seeds	3 15 0		By 161 thraves of straw, at 1s. per thrave	8 1 0	
	To harrowing and finishing	2 7 5		By interest on £36	2 16 0	
Sept. 29.	To half year's rent	12 7 6				
1794-						
Feb. 2.	To ditto ditto	12 7 6				
	To proportion of taxes	2 5 1				
	To thrashing 463 bushels of oats, at 1½d. per bushel	2 17 10½				
	To carting and expenses	1 4 11				
	To balance carried down	65 17 2½				
		<u>£ 146 4 11</u>			<u>£ 146 4 11</u>	
			1794-			
			Feb. 2.	By balance brought down, profit in four years	£ 65 17 2½	

It appears by the account, that in four years nine acres of clay land has produced corn to the amount of £437. 16s., and that the amount of rent, management, &c. was £371. 18s. 10d. leaving a profit of £65. 17s. 2d.; or a statute acre has produced £12. 3s. 2d., has cost £10. 6s. 7d. and left a profit of £1. 16s. 7d. on the average annually.

My neighbour broke up a field at the same time, in every respect the same as to soil, &c.; he did not manure it for the first crop of oats; and I found by his tithe that they did not average more than 34 bushels to the statute acre. The year following he sowed it with beans, and put upon it upwards of 25 tons of good dung to a statute acre. The beans averaged 32 bushels per acre; and after they were got in, he sowed it with wheat, which was poor indeed, not averaging more than 24 bushels to the statute acre. The year following he managed it very well, both in ploughing and manuring it, but the oats only averaged 35 bushels per acre, and the grass-seeds were not full, nor the field improved. I had communicated to my neighbour my ideas and intentions in respect to the management of my field, and we differed in opinion; but he is now convinced that he was wrong, and has since pursued my plan on all his lands under tillage, by making all his manure into compost, and of a different nature to the soil he has to put it upon, and using soap-waste instead of a double quantity of dung.

Thirdly. On Loamy Soils.

I managed two fields, of a strong red loamy soil, in the same manner as the nine acre clay field, except in the consistence of the compost, in which I used no sand. It consisted of dung, soap-waste, lime, and peat earth, and the crops were the best in this neighbourhood. For the wheat crop, I was honoured with a silver cup by the Society of Agriculture at Manchester; it averaged 50 bushels, of 70 lbs. each, to a statute acre. The produce was upwards of £30. *per cent.* more, and the profits near £50. *per cent.* more per statute acre than the clay field. They were laid down to pasture at the end of the fourth year, and improved to be of near double value to what they were before breaking up.

A field of a deep black loam, lying near the side of a river, was sometimes flooded, and, by injudicious management, was grown full of rushes. After having secured it from the floods, I broke it up, having previously pared and burned it, and put upon it a good dressing of compost, consisting of dung, lime, and sandy soil, which, in spreading, I mixed with the ashes; then ploughed it, and sowed it with turnips, which were carted off. The spring following I sowed it with beans, in the same manner as on the clay field before mentioned, but without manure; after the beans, with wheat; and the spring following I gave it a dressing of compost, in which I put soap-waste with the dung and sandy soil, and sowed it with barley and grass-seeds. The crops were all extremely good, a statute acre annually averaging a produce of £14. 5s. 7d. and a profit of £4. 1s. 1d. and the field is very much improved in every respect.

Fourthly. On Peat.

I had a piece of land that had formerly been covered with water, the sediment of which had formed a thin covering of mud upon a deep peaty stratum, lying on marl. It was divided into several compartments by ditches, but was very wet and boggy, the lower parts being full of flaggs and reeds, and the higher parts full of rushes and long sour grass, and comparatively of no value. I succeeded in effectually draining it, by cutting through the stratum of peat into the marl about one foot deep, making the drain in it about a foot narrower than that in the peat, which left edges, six inches broad, on each side the drain in the marl, upon which I laid stones to cover it, and then filled the drain in the peat, within about a foot of the

top, with gravel, stones, sand, and such other porous materials as I could get, and then filled it up with a mixture of peat and marl, that came out of the drain.

As the draining could only be done in summer, (it being so boggy that nothing could get on it in winter,) I was not enabled to crop it the year I drained it. The spring following I found it was become nearly firm and solid, and I pared and burned it, and then had it digged and planted with potatoes, without any manure but the ashes, of which there was great abundance, on account of the felt of flaggs, reeds, rushes, &c. there was upon it.

The produce of the potatoes was 426 bushels, of 90 lbs. to a bushel, per statute acre. After getting the potatoes, I guttered it to keep the surface dry; and the spring following, I put upon every statute acre about one rood (of eight cubic yards to the rood) of compost, consisting of lime and marl, about two measures of lime to a yard of marl, and sowed it with beans in drills, as before described under the head, Clays. The straw was very rank and long, but did not corn well, not having more than 34 bushels to the acre. By the spring following the land was grown firm, and I was enabled to plough it; and I again sowed it with beans, in the same manner as before, (conceiving that nothing else would stand upon it;) they were a very good crop, and averaged 51 bushels to the statute acre. The spring following I ploughed it, and put upon it about $1\frac{1}{2}$ rood (of eight cubic yards) of compost, of the same kind as before, and sowed it with barley, grass-seeds, red clover, white clover, trefoil, and rye-grass. The barley was a very good crop, having 50 bushels to the statute acre, and so much straw, that it prevented the grass-seeds from growing. Therefore, in the spring following, I ploughed it again, and put compost on it as before, and sowed it with oats, grass-seeds, red and white clovers, trefoil, and rye-grass. The oats averaged 53 bushels per statute acre, the grass-seeds were very full; and since, it has been as good a meadow as any in the neighbourhood.

I state the following account from my books, to shew the particulars and amount of the rent, management, and expenses, and also the amount of produce and profit of this piece of land, until it was made arable; and also to shew, that by spirited exertions and attention, land, that is literally of no value, may be made beneficial and profitable to the community and the individual.

Dr.	Damsteads, 7 A. 2 R. 21 P.	Cr.	
1787.	£. s. d.	1788.	£. s. d.
July 27. To cutting 1736 yards of drains, at 3d. per yard	21 14 0	Feb. 2. By amount per Dr. side	67 14 3
To 60 loads of stones, and carting, at 5s. 6d. per load	10 10 0		
To wheeling ditto, and laying drains, at 1/2 per yard	5 8 6		
To getting and carting gravel, stones, &c.	11 2 1		
To wheeling and filling drains, at 1 1/2 d. per yard	10 17 0		
Sept. 29. To half year's rent	3 16 3		
1788.			
Feb. 2. To ditto ditto	3 16 3		
To proportion of taxes	0 10 2		
	£ 67 14 3		£ 67 14 3
Mar. 1. To push ploughing 7 a. 2 r. at 10s. per acre	3 15 0	1788.	
To burning ditto, at 5s. per acre	1 17 6	Oct. 18. By 2946 bushels of potatoes, at 12. 6d. per bushel	220 19 0
Apr. 28. To delving ditto, at 1s. 2d. per 64 yards	33 1 6	By 261 ditto ditto, at 10d. per bushel	10 17 6
To 142 bushels of potatoes, at 12. 8d. per bushel	11 16 8		
To cutting ditto, at 3d. per bushel	1 15 6		
To setting and raking ditto, at 8d. per bushel	4 15 8		
June 1. To covering ditto, at 4d. per 64 yards	9 9 0		
Sept. 29. To half year's rent	3 16 3		
Oct. 18. To getting 3207 bushels of potatoes, at 1 1/2 d. per bushel	20 0 10 1/2		
Nov. 1. To guttering 187 roods, at 1 1/2 d. per rood	1 3 4		
1789.			
Feb. 2. To half year's rent	3 16 3		
To proportion of taxes	0 13 3		
To interest on £67.	3 7 0		
To balance carried to Cr. side	64 14 5 1/2		
	£ 231 16 6		£ 231 16 6

Dr.	Damsteads, 7 A. 2 R. 21 P.	Cr.	
1789.	£. s. d.	1789.	£. s. d.
Feb. 7. To feighting and soughing marl-pit - - -	4 17 3	Feb. 2. By balance - - -	64 14 5½
17. To 835 bushels of lime, at 8d. per bushel	28 13 4	By 254 measures of beans, at 5s. per measure	63 10 0
To getting marl, and mak- ing it into compost with lime - - -	4 10 0	By 167 thraves of straw, at 6d. per thrave	4 3 6
Mar. 1. To filling compost - -	2 15 0	1790.	
To carting and spreading 9 roods, at 18s. per rood	8 2 0	Feb. 2. By interest on £64. -	3 4 0
10. To drilling four days -	1 10 0		
To 13½ bushels of beans, at 5s. per bushel	3 7 6		
To laying beans in drills	0 13 6		
15. To harrowing, guttering, and finishing - - -	1 17 7		
Sept. 29. To half year's rent -	3 16 3		
Oct. 7. To reaping beans -	1 15 0		
28. To housing and expenses	1 7 8		
1790.			
Feb. 2. To half year's rent -	3 16 3		
To proportion of taxes -	0 13 1		
To thrashing 254 measures of beans, at 2d. per meas.	2 2 4		
To carting and expenses -	0 18 3		
To balance per Cr. side -	64 16 11½		
	<u>£ 135 11 11½</u>		<u>£ 135 11 11½</u>
Mar. 1. To ploughing eight days, at 7s. 6d. per day	3 0 0	1791.	
7. To barrowing four days, at 5s. 6d. per day	1 2 0	Feb. 2. By balance - - -	64 16 11½
12. To drilling four days, at 7s. 6d. per day	1 10 0	By 382 bushels of beans, at 4s. 6d. per bushel	85 19 0
To 13½ bushels of beans, at 5s. per bushel	3 7 6	By 134 thraves of straw, at 6d. per thrave	3 2 0
To laying ditto in drills	0 13 6	By interest on £64. -	3 4 0
To harrowing, guttering, and finishing - - -	2 1 3		
Sept. 29. To half year's rent -	3 16 3		
To reaping beans -	1 15 0		
Oct. 15. To housing and expenses	1 3 9		
1791.			
Feb. 2. To half year's rent -	3 16 3		
To proportion of taxes -	0 18 9		
To thrashing 382 bush. beans	3 3 8		
To carting and expenses -	1 4 7		
To balance per Cr. side -	129 9 5½		
	<u>£ 157 1 11½</u>		<u>£ 157 1 11½</u>

It appears by the above account, and the management before described, that a picce of peat land of 7 a. 2 r. 21 p. has been reclaimed; that in four years the amount of rent, expenses, &c. was £323. 3s. 3d.; that the produce amounted to £567. 18s. 4d.; and the profit to £144. 15s. 1d.

It is the common and almost universal practice of farmers, who have peat land, in this county (Lancashire), to marl it the year before it is broken up; and the spring following to pare and burn it, sow it with barley and clover, then pare and burn it again, crop it as before, and so on alternately, until the whole of the marl is reduced to ashes, and the land worse than in a state of nature, the soil being reduced, and its vegetative powers destroyed.

It is a very bad (though common) practice, to put marl in its crude state on peat land. The marl, being a much closer and heavier body than the peat, prevents their incorporation, and it soon sinks too low to be of any service.

Having kept a particular account of the management, expenses, produce, &c. of every field I have, and the same duly and regularly posted, it has not only shewn me how each field has paid me, by any particular mode of management, but has served as a journal and register of my proceedings, from which I have drawn the preceding statements, which will shew to a demonstration that grass lands may be broken up to pay the undertaker from £20. to £35. *per cent.* on the amount of rent, management, &c. and "returned again to grass after a certain period in an improved state;" and also, that what I have stated (and intend to state) are not speculative opinions, but the result of actual experiments. They also shew the methods of management, course of crops, &c. to produce the effect, which I prefer to any other I have seen or practised; and I will endeavour to explain my reasons for so doing, and, at the same time, answer as much of what is required by the Honourable Board of Agriculture as I have any knowledge of, in the best manner I am able.

The principal reason for preferring such methods of management is, I have tried them, and found them to answer in every respect.

Sandy soils in general are of a very porous nature, and soon lose the effect of manures put upon them; perhaps, by too quick an absorption, and permitting too free an evaporation. To counteract these imperfections, I have used manures of a nature directly contrary. Marl is superiour to any other manure, not only on account of its fertilizing qualities, but by giving adhesion to the particles of the

soil, when incorporated therewith, which causes it to retain the effects of manure much longer.

Marl, when applied on dry light sands, is best in its crude state; they soon absorb the moisture the marl contains, and partake of its qualities, and the marl is more binding in that state than any other.

Where marl cannot be had, clayey soils and strong loams are good substitutes; even clay, when judiciously managed, I have found to answer a good purpose. The best method of distinguishing marl from clay, is to apply strong acids (as aquafortis, &c.) on it; and if it effervesces freely, it is supposed good marl, possessing some alkaline qualities, and free from noxious weeds, such as thistles and coltsfoot, which clay, that will not effervesce in acids, generally produces; therefore when clay is used it should be made into compost with lime, which will destroy the vegetative powers of the roots of noxious weeds generally contained in it.

Sandy soils are more adapted to the growth of potatoes than any other sort, except peat: the fibres extending themselves more, and shooting more freely, the potatoes grow larger on sandy soils, that have been previously marled or manured with binding manures; and in getting them up, the manure is perfectly mixed and incorporated with the soil. Manures, put upon sand land when under tillage, should not be ploughed in, but laid on the top and harrowed in with the seed; for if the manure be compost of a different nature, its specific gravity is generally more, and it soon sinks sufficiently deep, and by being mixed with the seed, it gives vigour to the vegetation of it, and supports it through its growth, by following the fibres of the roots as they strike into the land. I need not remark, that, previously to laying any kind of land down to grass, it is necessary to make it perfectly clean; when it is so, it should have a good dressing of manure harrowed in along with the seed.

Sandy soils are sooner brought into condition to receive the seed; they imbibe the fertilizing virtues of manures more quickly, return them more freely, and are sooner exhausted by a repetition of ploughings than any other kind of land; and I have found that ploughing them for more than four crops causes them to lose the spontaneous growth of their natural grasses. When grass lands are converted into tillage, with an intent to lay them down to grass again after a certain period, they should not be kept under tillage longer than that period. Land will grow its natural grass

spontaneously for a certain time while under tillage, and afterwards a spurious kind will appear among the corn.

It seems that the influence of the atmosphere is necessary to give powers to the land to support vegetation. I will not pretend to explain the reason, but I have found, that when five inches have been taken off the surface of sand land, and four inches off clays and loams, that the soil under will be barren for a certain time; therefore in breaking up grass lands, if in the spring, with an intent to sow them after the first ploughing, they should not be ploughed deeper. It is better to plough any kind of land that is intended for a spring crop, before the frosts generally set in; and then it may be ploughed deeper, as the barren soil, then turned up, receives the beneficial and salutary effects of the frosts and weather, which makes it fertile, and causes it to incorporate with the vegetative soil, and adds to its thickness.

Lands thin of soil, by being ploughed a little into the under stratum in autumn, and lying during the winter, gain a little in thickness of soil by every such ploughing, as the stratum, turned up, is meliorated by the frosts and weather, and incorporates with the soil.

The course of crops I find to answer best on sand land, is, first, turnips or oats, next potatoes, then wheat, and lastly barley, among which grass-seeds grow better than with any other grain, as the straw is finer, and permits them to grow more freely.

I have always kept my meadows clean from weeds, and the hay, arising from different qualities of land, in separate parcels, and collected the seeds that have fallen from it with care; these according to the sort of lands the hay, they came out of, grew on, I have sown along with artificial grass-seeds, on lands of the like nature.

Upon sand lands I have sown about five pounds each of white clover and trefoil, and a bushel of rye-grass, with about a bushel of grass-seeds (collected as above) to every statute acre, and have always found it to answer; and I prefer mowing land (intended for pasture) the first year after laying down to grass, as it gets a more compact and a firmer sward, and is not injured by the treading of the cattle; the hay will pay for a light dressing of compost as manure, which should be applied as soon as the hay is got; and the land will in every respect be improved.

Clay land is the most obstinate kind of land to manage; it is nearly impervious to the fertilizing influence of the sun and air, as well as of manures, and is tardy and ungrateful in its returns. It is necessary to infuse a stimulus into it, before it will answer; and I have found manures of a direct contrary tendency best adapted to that purpose. Hence sand and peat earth, when impregnated with some alkaline virtues, are best calculated on account of their porous natures; even these, without caution and attention, often lose the effect. They should be mixed by slow degrees; for, if ploughed in, they are inclosed by an impervious body, and become of no effect, until they are released by another ploughing; and clay lands cannot be ploughed but at certain seasons. It is said here, they are either brick or mortar, that is, too dry or too wet. Therefore, in breaking up grass lands of a clayey nature to convert them into tillage, they should be ploughed in November, and laid as open, and with as much surface exposed, as possible, that they may be meliorated by the frost and weather; and in the spring, give them a dressing of manure of a porous nature, and harrow it in along with the seed; this mixes it a little with the soil, and nourishes the vegetation. After getting the crop in autumn, the land should be ploughed, that it may again be exposed to the weather to receive its salutary effects; this meliorates the soil, covers the manure, and preserves it during winter. Ploughing it in spring throws the manure up, and mixes it with the soil. With every spring crop a dressing of manure should be given, and that mixed with the soil by good harrowing, or by drilling the land with a drill-plough, about three inches deep, sowing the seed in the drills, and then harrowing the land, by which means the manure is mixed with the soil that depth.

The course of crops I find to answer best on clay lands under tillage, is, first oats, next beans, then wheat, and then oats, and (if intended for tillage after) red clover among the oats; but if intended to be laid down to grass, white clover, trefoil, and rye-grass. Clovers grow more luxuriantly on clay lands than other grasses, having strong, penetrating, branchy roots. Clays grow heavy crops of red clover, when judiciously managed; but after mowing, the land is barren of grass, red clover being an annual grass.

While clay land is under tillage, it should be laid round, to throw off the water, and gutters made, at little distances from each other, to receive the water from the furrows, that it may not run in great quantities to carry away the soil, and starve the land.

Strong red loams are susceptible, but have a clayey nature. I find them to answer when managed like clays. As they possess sand, peat earth when decomposed and made into compost with dung, &c. answers best as manure for them.

Rich black loams possess every quality for vegetation, and in general only want something to open and stimulate them. Hence I find dung, lime, and sand, to answer on the first ploughing; the dung inciting to action, and the lime and sand opening the pores to receive the salutary influence of the atmosphere. They bear all kinds of crops luxuriantly; but the course of crops I find most profitable is, first, turnips, then beans, next wheat, and then barley with grass-seeds, when intended to be laid down to grass, manuring the first and last crop. All kinds of good grass-seeds grow spontaneously upon them, and a mixture of artificial grasses answers best.

About 12 lbs. to a statute acre of white clover and trefoil and a bushel of rye-grass is sufficient for loams. On clays 15 lbs. should be sown, and a double quantity of grass-seeds. Upon lands that will grow barley, the grass-seeds grow best among it, and among oats on other lands.

Land of a peaty nature, that has been improved and laid down to grass, when converted into tillage, should not be ploughed for more than two crops, if intended to be laid down to grass again; it is very free in nature, but very weak, and soon exhausts itself. It gives the heaviest crops, and the best quality of potatoes; and it is the practice of most farmers in this district of the county of Lancaster, where the growth of potatoes is attended to and managed in a superiour manner, to crop land of this description, first with potatoes, then wheat, among which, in the spring, they generally sow red clover, if they intend to lay it down. This is a profitable course of crops for the moment, but it exhausts the land; and to bring it into good order, an expensive course of manuring is necessary. I find the best method of management to be, to plough it in spring, and give it a good dressing of invigorating, binding manures, and sow it with turnips, and the spring following with barley and grass-seeds. If laid dry, (which all lands should be, previously to being converted into tillage,) eating the turnips on the land with sheep would be an improvement on this kind of land, and they would make it more close and firm; being of a soft, elastic nature, it is injured by pasturing the first year after laying down, and is, while under grass, best adapted for meadow land.

The first and great object in the management of peat land, in its uncultivated

state, is to drain it; to do which, where there are large tracts, is often very difficult and expensive. Remove the cause, and the effect ceases, is an old adage.—The plan of draining, for which Mr. Elkington received a parliamentary reward, though in many cases very useful, is slow in its operation, and particularly on peat land, which is spongy, elastic, attractive, and retentive; therefore, to get land of this kind into immediate use, an open cut or a sough should be brought up from a level that will take the water from the peat to a certain depth, which should be through the peat if possible, and then drains cut in oblique directions at short distances from each other, to discharge themselves into the main sough or drain, which should be carried through the piece of land intended to be drained. The drains should be soughed with stone, and filled with gravel, sand, or any porous materials that discharge themselves freely; for if filled up with the peat earth that comes out, it soon unites again, (unless it be cut in square pieces and thoroughly dried,) and prevents any discharge, but just over the sough; whereas, if the drain be filled with gravel, &c. the peat discharges itself at the sides of the drains into the gravel, &c. with freedom, which it runs through quickly into the sough under it. Cutting the drains, and letting them remain open some time, is a good plan; it makes it better for soughing; and where gravel, &c. cannot be had, gives an opportunity of drying the peat, which, when thoroughly dried, will not return into its pristine state again. As soon as the land is drained, the next object is to get it pared and burned, which is absolutely necessary on uncultivated peat lands; as they contain, if moory, a thick tough coat of heath, which is bad to separate; and if sedgy, &c. deep strong roots, that it is necessary to destroy; these, when reduced to ashes, are good manures, and soon introduce themselves into the peat, the particles being fine. When the peat is drained, it becomes very tough, being firmly united by the fibres of a variety of roots contained in it, and, until separated, will not incorporate with any manures put upon it.

I have found the following management of uncultivated peat-land to answer in every respect.

I have drained, pared, and burned it, and then planted it with potatoes; and, by getting them up, opened and separated the land; then I have put upon it marl and lime mixed, (about a rood of eight cubic (64) yards to the statute acre,) every crop for three succeeding crops after the potatoes. Mixing marl and lime dries and separates the marl, and in that state it sooner incorporates with the peat than when

put on in its crude state; and by putting it on by small portions at once, prevents its sinking, which, when put on in its crude state in larger quantities, it soon does, as I have before observed.

Beans grow luxuriantly after the potatoes, and barley after them; and while the marl is fresh in peat-land, it grows full crops of red clover, but it soon exhausts it; when laid down to grass, a mixture of artificial grass, about 15 lbs. with two bushels of grass-seeds collected from good hay, answers very well; they should be sown among barley or oats, and the land should be continued as meadow-land while under grass.

Not to drain land before breaking it up, that is in any degree wet or spongy, is very bad management indeed; for when wet, land requires double the trouble and expense to bring it into condition, starves the manures, and bursts the seed in its vegetation; and the corn is lean and unkindly. When drained, the cause is removed, and the effect ceases. But when effectually done, it is a lasting improvement, and a great portion of it should be done by the land-owner. I have done a great deal of draining, and my landlord has allowed me for the cutting of the drains, the stones at the quarry, and for laying the drains; I have carted the stones, filled up the drains, and finished them. This is a fair thing between landlord and tenant; and where draining is necessary, a beneficial improvement to both.

Paring and burning is a ruinous system, when constantly practised; it forces for one crop, but afterwards the land is impoverished, the soil is reduced, and eventually its vegetative powers destroyed.

On uncultivated peat-lands, &c. and old lying meadows that are grown full of rushes, &c. paring and burning is useful and necessary to bring the land into condition, for the swards are so tough and so fast united together by the roots they contain, that it is almost impossible to separate them by any other means. On lands that have been under irrigation, I have found paring and burning useful, by destroying the seeds left by the water. I have seen crops of corn on such lands of very little value, owing to the weeds vegetated from the seeds the water has left on before ploughing, and which when permitted to seed in the corn have made the land so full, that it has been difficult to get it clean. The dock-seed often floats upon water, and will vegetate when several years old, and when land, that has its seeds upon it, is ploughed, docks generally appear in abundance: and when they have

once got rooted, they are very bad things to destroy, the roots being of the polypus kind. Paring and burning the land destroys all the seeds it contains, to the depth it is pared.

When land is pared and burned, I hold it a good and profitable plan to give it a dressing of compost of carth, &c. and spread the ashes and it together while they are yet warm, and immediately to plough them under; the ashes impregnate the compost with their saline virtues, and the compost replaces the soil destroyed, and gives duration to the effects of the manure.

Paring, or push-ploughing, as it is provincially called here, should be done early in spring, and the sod, on cultivated lands, cut, from half an inch to an inch deep, and on uncultivated lands, from an inch to two inches deep, and the breadth from nine inches to a foot; the length depends upon the toughness of the sward, and the strength of the workman. If a succession of fine weather ensues, the sods need no removing until they are put upon fires to be burned; but if wet weather ensues, it is necessary to set them upon their edges in a semicircular or angular form, which is provincially called win-rowing, I suppose from their being put in a position that the wind can blow through them. When the sods are dry, they are laid round locks of straw, or faggots of furze, &c. until they are from three to six in thickness, according to the dryness of the sods, and sort of soil they are of. Care should be taken to lay the sods, so that a free circulation of air may pass between every one, and that the grass side is downwards; a hole is left to set fire to the furze, &c. which, as soon as the fire has got full hold of the sods, should be stopped up, and the fire carefully attended to, and the sods shifted according as it burns more on one side than another, which the wind will cause.

When grass lands are converted into tillage, the opportunity should be embraced of removing all useless banks, copse, &c. and where the headlands are higher than their annexed lands, of reducing them to a proper height; also of replacing any dead wood, and putting quicksets in the places, and of improving the fences generally. The corners of the field which cannot be ploughed should be digged, and all the land made to grow corn, or something useful, as the parts neglected not only serve as seed-beds for all kinds of noxious weeds, (which, when ripe, the winds sow on the cultivated lands,) but so much land is lost, which pays the same rent and taxes (in proportion) as the others, and, instead of being useful, is prejudicial. I have always practised the above plan; it gives neatness to utility; and the Society of Agriculture

at Manchester honoured me with a silver-cup;—a flattering token of their approbation of the neatness of my farm.

In reducing the height of head-lands, the surface should not be taken away; if it be, the soil under will be barren, until it has partaken of the fertilizing effects of the atmosphere, and which soil, if ever so well manured, requires a long time to make it equal with the other land, although it be equally deep. A good plan is, to make a trench at one end of the head-land, and throw the surface soil into it, until it is the height required, and what soil there is to spare, to throw it out of the bottom, and so on until the head-land is reduced to the height required. The bottom soil, by being made into compost, soon becomes of a fertilizing quality, by the fermentation it undergoes when compost is properly managed.

When copse and hanks, &c. are removed, they should be taken nine or ten inches below the level of the land, (if the soil be so deep,) and the space filled up with some of the surface soil, which should be laid aside for the purpose.

When grass lands are converted into tillage with an intent to lay them down to grass again, after a certain period, without injury, they should be manured for every other crop at least, and always with the last crop; and compost (composed of some fertilizing manures and earths of a different nature to the land it is to be laid upon) is best for land under tillage; indeed for land in every state I have found it most beneficial. On grass lands it sooner introduces itself among the roots of the grass, and on lands under tillage sooner incorporates with the soil; and, when properly managed, sooner conveys its fertilizing qualities, and in a more equal manner and with less loss of its virtues than any kind of dung in its crude state.

I have before observed, that too much attention cannot be paid to compost in its several stages and operations. I have found that the art of making compost should be studied with due attention, and that the difference of the value of compost properly managed, and that made in a common and negligent manner, is to a farmer a very serious consideration. The method of managing compost, which I have practised with profit and success, is as follows: I previously prepare the materials, and, according to the quantity of each material, proportion the thickness of each layer, not making any more than six inches, laying first a layer of one material, and then of another, and so on alternately, gradually decreasing the breadth of the heap, until it is reduced to a point at the top, forming an angle. If the materials are likely to be tardy in beginning to ferment, I put a few lumps of quick-lime

into each layer, and beat the sides of the heap with a spade to keep out the weather. I then attend its fermentation with as much care as a brewer does his liquor; and the moment I find that the heat begins to abate, I turn the heap over and chop it very fine as I do it, and throw the outsides and bottom of it into the middle of that made by turning it, preserving the same form as before, and again beating the sides to keep out the weather. By turning it while yet hot, a fermentation takes place in the second heap, and by throwing the outsides and bottom of the first heap into the middle of the second, the whole mass becomes completely putrified; all weeds and extraneous matter are destroyed by the fermentations, and the compost is in a perfect state when it has lain about two months after the last turning, and presents a mass of matter superiour as manure (in my opinion) to any other. Keeping the weather out of it is a very material point; but to keep up the fermentations, until the whole mass has thoroughly partaken of its effects, is the great object to be attended to.

By making all manures into compost with earth, (of which useless banks, copse, cleaning of water-courses, gutters, ditches, &c. in general offer a sufficient quantity,) the soil, which is lost by variety of means when lands are under tillage, is replaced, and the thickness of the soil rather increased.

In converting grass lands into tillage, care should be taken that it is done in a manner that the prices of cattle may not increase beyond their value, by their numbers being decreased by converting grass lands into tillage; this would be attempting to remove one evil, at the certainty of creating another.

By extraordinary management extraordinary crops may be obtained; and by it and the following method of cropping land, the same quantity of stock, cattle, &c. may be kept as at present, and an increased quantity of corn grown, by converting grass lands into tillage. Suppose a piece of land be ploughed that grew hay as winter food for a certain number of cattle, stock, &c. they must have a substitute, if kept; but if other lands are laid down to grass for the purpose, the object of growing more corn is not obtained; now if one half of the land converted to tillage be cropped with potatoes, and the other half with grain, then the half that had potatoes with grain, and the other with potatoes, and so on alternately, until laid down to grass again, the potatoes off one half of the land will keep more cattle, stock, &c. than the hay off the whole; and potatoes are the best substitute for hay for horses, being a very wholesome nutritious food for that animal as well as for every other.

If old pastures are broken up, some other land must be laid down for pasture; and the only advantage the tenant can reap from it will be (perhaps) a better crop of corn from the fresh land; and if he lays the land down well that is for pasture, the expense of manuring, &c. will be equal to any advantage he will receive from ploughing the other. No increase of rent should take place; but the tenant should buy as much manure for the land laid down to pasture as the increased value of the crop of corn, which, perhaps, on an average, may be £4. per acre, and also to provide all grass-seeds at his own expense.

It may be said, Where is all this extraordinary manure to come from? The earth contains inexhaustible stores, which are very little known; and manures in general are injudiciously managed.

Would it not be an object of importance to a land-owner, to know what his land contained in its bowels, and in what manner such stores might be applied in agriculture in a beneficial manner; also to have the advantages pointed out, which situations offer for draining, irrigation, &c. They are neglected by many eminent good farmers.

If, from what I have wrote, any useful information can be drawn, I shall feel myself happy in rendering a service to the community.

COMMUNICATIONS
TO THE
BOARD OF AGRICULTURE;
ON SUBJECTS RELATIVE TO
THE HUSBANDRY,
AND
INTERNAL IMPROVEMENT
OF THE COUNTRY.

VOL. III.

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PART II.



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COMMUNICATIONS
TO THE
BOARD OF AGRICULTURE.

*An Essay on the best Means of converting Grass Lands into Tillage, &c. &c.
by Mr. J. Bailey, of Chillingham, Northumberland.*

SECTION I.

INTRODUCTION.

THE Board of Agriculture having proposed "to examine into the best means of converting certain portions of Grass Lands into Tillage, without exhausting the soil, and of returning the same to Grass after a certain period, in an improved state, or at least without injury,"—I have in the following pages, put together what has appeared to me, (from the experience and observation of upwards of thirty years,) to be, the most beneficial modes of practice for obtaining so desirable an object.

The species of grass land meant by the Board, I suppose to be lands, that have been continued many years in pasture, and have been kept in that state, from the apprehension that if suffered to be ploughed they would be greatly injured by the operation, and could not be let for the same rent per acre for many years to come.

There are certainly large portions of old grass land, or grazing pastures, in many parts of the kingdom, that are perfectly free from moss, ferns, ant-hills, rushes, &c. and covered with a rich and luxuriant herbage, which it would be almost a sin to destroy; and a very doubtful point whether, if converted into arable, they could be let for any length of term, for the same rent they are worth at present; or, after being laid down to grass again, could be brought in many years to produce as valuable herbage as their present surface exhibits. Under this head I would include all lands which will depasture five or more sheep an acre, through the summer, or two oxen to three acres.

It is also equally certain that there are numberless portions of old grass lands of a very different description, which, in the technical phrase of farmers, are become "hide bound" and "dead," and deteriorated by moss, ferns, rushes, ant-hills, gorse, &c. &c. which there can be no hesitation in asserting, that they may be employed in a much more advantageous manner, by being converted into tillage. Under good cultivation they would produce abundant crops of grain, and, in proper time, might be laid down to grass in a much better state for pasturage than they are at present.

The modes of accomplishing this object will vary with the different kinds of soil: to notice every slight variation, in a work of this nature will not be necessary, and I shall therefore arrange them under four distinct heads or classes, viz. Clayey, Loamy, Sandy, and Peaty Soils. And I must premise, that whatever be the soil, wherever there are out-twists of water, weepy places, or bogs, they should be all drained previous to every other operation.

SECTION II.

Clayey Soils.

Under this head I would include all such, as are too strong for turnips, or such as are too wet for getting them off in winter, of which there are numberless gradations.

A deep loamy clay, on an absorbent or marly *substratum*, is probably one of the most productive for grain of any other; while a soil of a thin staple, on a *substratum* of ochrey clay, impervious to water, is one of the most ungrateful soils I know, and the most unpleasant to cultivate.

Old grass lands, which arrange under this class of soil, may be converted into tillage, either by ploughing down the lea, or by paring and burning.

If the former operation be adopted I would recommend the land to be ploughed as early in the autumn as possible, in order to receive the benefits of the whole of the winter frosts; the amelioration which the soil receives by this means is of the greatest consequence to the succeeding operations, and crop.

The depth to be ploughed should not be less than six inches, where the staple of the soil will admit of it; but trench-ploughing I think preferable, which may be performed by two ploughs, going one before another, the first paring off the surface about two inches deep, and laying it into the bottom of the furrow, while the other plough follows, and turns up the under soil about four inches deep, to cover the

surface-sod,* by which means the land pulverizes much better with the harrows; and beans and pease may be drilled upon it with great facility, which is a considerable advantage on soils most proper for those grains.

The rotation of crops may be as follows :

On deep loamy clays, 1. Oats.

2. Beans, drilled at thirty inches.
3. Wheat.
4. Fallow.
5. Barley.
6. Grasses.

If the soil be too strong for oats, which is often the case, then,

1. Beans drilled, *the land trench ploughed.*
2. Wheat.
3. Fallow.
4. Barley.
5. Grasses.

Upon soils where the staple is too thin, or *substratum* improper for beans, the rotation should be,

1. Oats.
2. Fallow.
3. Barley, or wheat, *if drilled.*
4. Grasses.

Where the soil is too strong for oats, then,

1. Pease.
2. Fallow.
3. Barley, or wheat, *if drilled.*
4. Grasses;

and if the soil be too poor for pease, then,

1. Tares.
2. Fallow.
3. Barley, or wheat *drilled.*
4. Grasses.

* There are ploughs made to perform this operation at once, but as they require four horses and two men, there is no saving in it; and two common swing ploughs do the work equally well.

For the drilled beans, the lands should be ploughed immediately after the oat crop is carried off, (and kept perfectly clear of stagnating water,) to receive the influence of the atmosphere through the winter. In February, the beans should be drilled at thirty inches intervals, at the rate of two bushels to an acre; and horse and hand-hoed, at least twice through the summer, to keep them perfectly clear of weeds; and after the last hoeing, the stems should be earthed up, by a double mould-board plough, going through every interval.*

As soon as the beans are carried off, the land should be immediately horse-hoed and harrowed, by which means any weeds that had escaped the summer hoeings will be brought to the top, and gathered. After the horse-hoeing, I generally spread four or five cart loads of lime upon every acre, then plough up into proper-sized ridges, and sow with wheat.

The year after the wheat is intended for naked fallow, and in order to have this in the greatest perfection, no time should be lost in getting the land ploughed before winter; always remembering to keep it perfectly free from stagnating water.

The necessary operations requisite for making a complete good summer fallow are so well known that I need not detail them here, and shall only observe, that if the object be, for the land to continue in grass, it will be absolutely necessary to give it a good liming; the quantity depends on the quality of the lime, and is best known from experience. This to some people may seem strange, who have not attended to the effects of different kinds of lime, and on different soils; the most experienced cultivators in the County of Durham and North Riding of Yorkshire, dare not use more than three or four loads an acre, while an East Lothian farmer has no fear of fifteen or twenty loads an acre; therefore the quantity must, in a great measure, depend on local knowledge; but when the land is intended to continue in grass, I would recommend an *extra* quantity, as there is nothing tends so much to what the farmers call "sweetening a pasture," or the production of proper grasses, as a due portion of lime; I have had repeated opportunities of observing its beneficial effects, in producing palatable grasses, on a variety of soils; but as we are confined, in this instance, to a particular soil, I shall at present only relate the result of an experiment made on this variety, with respect to lime.

A field of 14 acres, which had been in pasture for upwards of twenty years, was

* For the implements necessary for this culture, and a more detailed account of the necessary operations, see the Report for Northumberland, 3d edit. p. 92.

ploughed out, and, 1st. sown with oats; 2d. drilled beans; 3d. wheat; 4th. fallows; two acres of which were sown with turnips, drilled at thirty inches intervals, and dunged with twenty-five cart loads of dung, per acre, *but no lime*: the remainder was a complete naked fallow, limed with five cart loads an acre, and dunged with fifteen cart loads of dung; this part was sown with wheat, which proved a great crop, though in many parts lodged, and the grass-seeds injured. The two acres, after turnips were sown with barley after three ploughings, and the whole sown on the same day with grass-seeds, in the following proportions per acre; viz. 8lbs. of red clover; 4 lbs. of white; 3lbs. of yellow; 4 lbs. of rib-grass, and a bushel of ray-grass; the first year there appeared no difference; the second year the two acres, which had not been limed, produced a great quantity of *fine bent-grass*, (*agrostis capillaris*), and the third year considerably more, while those parts that had been limed, did not produce a single plant. Having observed the same circumstances take place upon dry soils, I suspected the cause, and spread six cart loads of lime per acre, upon those two acres that produced such an abundance of this species of grass, which I well knew no cattle would eat; at the end of two years after this liming, there was not a single plant of the *agrostis capillaris* to be seen, and this part of the pasture, which before the liming was totally neglected or avoided by the cattle, is now eaten equally bare as the rest; and the whole is covered with a fine verdant surface, and of more value for grazing, than when ploughed out.

The quantity of manure per acre requisite to be laid upon the fallow, must be regulated from a knowledge of the soil, whether it be in a high state of fertility, or in the opposite extreme; if too large a portion of dung be laid on, the crop will lodge, and not only be of less value itself, but will greatly injure the grass-seeds, if not entirely destroy them; therefore this matter must be left to the discretion of the practical farmer, as no general rules can be given. Twelve or fifteen cart loads an acre will be quite sufficient for some soils, while others will take double the quantity.

As the object is to have the lands laid down to grass in the best state possible, I would recommend the fallow to be ploughed up into proper-sized ridges in the autumn, to remain in that state till the spring following, and to be then sown with barley, and grass-seeds, in the following proportions:

Red clover	-	(<i>trifolium pratense</i>)	-	albs.
White clover	-	(<i>trifolium repens</i>)	-	8lbs.
Yellow ditto		(<i>medicago lupulina</i>)	-	4lbs.
Rib-grass	-	(<i>plantago lanceolata</i>)		6lbs.
Ray-grass	-	(<i>lolium perenne</i>)	-	1 bushel.

No kind of stock whatever to be suffered to come upon the barley stubble in autumn, or through the winter, nor till the latter end of April, or beginning of May, in the spring following.

The consumption of the grass crop ought certainly to be by pasturing, and that principally with sheep, as they do the least injury to land by poaching, and enrich it the most, of any other stock. At all events it ought to be pastured, and not by any means cut for hay, as mowing is destructive to white clover, and prevents the dissemination of other grasses, by the seeds produced from the stems, left untouched by the grazing stock.

It may probably be objected, that red clover being a biennial, is improper, where the intention is permanent pasture; but this objection will lose its force, when the smallness of the quantity is considered, and that it is added solely with a view of making an increased pasturage for two years; while the white clover is gathering strength, and filling up the vacancies by its creeping shoots. At the end of the second year, a top-dressing of manure or compost has a most beneficial effect, in securing a thick matted turf of grasses.

It may also be objected, that in the rotation of crops, there ought to have been no naked fallow; but that the grass-seeds should have been sown upon the wheat after the drilled beans: to this I answer, that as the object is "to have the land returned to grass again in the best state possible," I have learned from the result of many experiments and observations, that this can only be obtained with certainty from a naked fallow, in the manner above recommended; and that grass-seeds are exceedingly hazardous after beans, the red clover being liable to be destroyed in the seminal leaf, by a small gray snail, which I have found more prevalent after beans, than any other crop, and have seen many instances, one of which I shall mention, where a field was in part drilled beans, part rape, part potatoes; the clover after the potatoes and rape was perfectly good, but that, after the beans, was totally destroyed.

It may also be asked, why not sow wheat after the summer fallow? I answer;

because the wheat being sown in autumn, the surface of those strong soils get *bratted*, or hardened so much through the winter, that there is generally no mould, or pulverized soil, not even with barrowing, for the small grass-seeds to vegetate in, and of course they lie upon the surface uncovered and of no use; but when the lands are ploughed up in the autumn, and left in a rough cloddy state through the winter, and the barley sown without any further ploughing, the grass seeds are deposited in a bed of finely meliorated earth, in which they never fail to vegetate.

Where drilling of grain is practised, the above objection may in a great measure be obviated, by horse and hand-hoeing the wheat in the spring, and then sowing and harrowing in the seeds; but as few people are provided with the proper apparatus for those purposes, I therefore recommend the other, as being more generally practised.

The other mode of breaking up old grass lands of this description, is by

Paring and Burning.

In many parts of the kingdom converting old grass land into arable is frequently attended with considerable risk to the cultivator, by the crops dying off ("leaping") for two or three years, occasioned most commonly by the wire-worm, and various species of grubs, and sometimes with a combination of other circumstances: the most effectual remedy or preventive for this calamity is paring and burning; and this is the great inducement for the practice being so general in the county of Durham, and North Riding of Yorkshire.

To those districts where paring and burning is not practised, the above fact may probably be unknown, and probably the heavy losses occasioned by crops "leaping" are also unknown; but if their lands are subject to this kind of failure, I would beg leave to recommend the adoption of paring and burning, in breaking up old grass land, as the best preventive, and this they may safely do without any fear of destroying the soil, or injuring the fertility of the land; provided that they pursue a proper rotation of crops, and that the land be laid down to grass again, in four or five years.

The spring months are the best for paring and burning; and in general the sods may be got burned by the latter end of May or beginning of June; in which case it may be sown with rape, to be eaten with sheep in August and September, and then sown with wheat.

The rotation will then be,

1. Rape and wheat.
2. Beans.
3. Oats.
4. Fallow.
5. Barley.
6. Grasses ;

but if the land cannot be got ready in time for rape, then the course will be

1. Wheat.
2. Beans.
3. Oats.
4. Fallow.
5. Barley.
6. Grasses.

If the soil be too thin for beans, then the following rotation may be pursued :

1. Wheat.
2. Fallow.
3. Barley.
4. Grasses.

In favourable seasons, when the sods can be got burned by the latter end of April or beginning of May, I have frequently known barley sown upon pared and burned land with great success : indeed one great advantage of paring and burning is, the certainty of full crops. I do not recollect an instance where the cultivator was ever disappointed ; and it is this amazing fertility, that has tempted many people to go on with repeated corn crops, until the soil was exhausted ; and then, instead of blaming their own imprudent conduct, they are ready to lay the blame on this operation : it is the injudicious cropping, more than any bad effects derived from paring and burning, that has been the chief cause of bringing such an odium on this practice : some people assert " that it destroys the soil ; " but this I can by no means admit, and I am inclined to believe, on the contrary, that not a single particle of earth is lost or destroyed. The bulk of the sod or turf is certainly diminished, but this arises from the burning of the roots or vegetable matter, which by this process are converted into alkaline salts, and other principles friendly to vegetation ; but the earth is left undiminished in the ashes, and probably in an improved state,

from having passed through the fire; but however this may be, the fertilizing effects of this process are well known to every cultivator that has been accustomed to the operation; I believe it will be found, that those people who raise such a clamour against paring and burning, are, in general, those who have never practised it; or who have practised it improperly.

Those who have not been accustomed to plough pared and burned lands it may be necessary to caution against ploughing too deep: the first ploughing should be about two or two and a half inches deep, and the width of the furrow about five or six inches; on this, rape, or turnips, may be sown, after being harrowed; but for any kind of grain it should have a second ploughing, about three inches deeper than the first; that is, about five inches in all, which makes the land harrow fine, and mixes the ashes more intimately with the soil.

The subsequent operations for the different crops will be the same as recommended in the other mode of breaking up this species of soil, as well as the following, liming, manuring, &c.

I have frequently seen lands of this quality when ploughed out from old grass, produce abundance of wild oats (*avena fatua*) and runch, or charlock (*sinapis arvensis* and *rapbanus rapbanistrum*), so as to be exceedingly prejudicial to the crops of grain; in such cases, every crop, of whatever kind, should be drilled; and those destructive pests to the farmer, will, by proper hoeing, in a few years be totally extirpated; this I can recommend from the experience of several years.

It is well known to practical farmers, that clay soils are the most expensive, and most difficult to cultivate, of any; too much wet, or too much dryness, puts a total stop to every operation; and when laid to grass they are the longest in covering with a thick matted coat of plants, so as to afford a profitable pasturage; and it is probably on those accounts, that so large a portion of these soils is continued in grass, and applied to the various purposes of grazing, the dairy, and rearing young cattle. There is no doubt however, but that many of them might be employed to greater advantage, by alternate changes from grass to arable, and from arable to grass, could the owners be once persuaded of the propriety of the measure.

SECTION III.

Loamy Soils.

Under this head, I include all lands proper for growing turnips, and sufficiently dry for getting them off in winter. These soils are cultivated with more satisfaction, and less expence than any other, the various operations being seldom interrupted by too much wet, or by extremes of drought, which is very often the case with soils of the last class. There are probably few old grass pastures, of this kind of soil, which might not be converted into tillage with advantage, and be worth more rent, under alternate arable and grass crops, than they produce by being kept continually in pasture.

There are few soils of this description, but what will produce good crops of oats immediately on being ploughed out from grass. They ought always to be ploughed before winter, if it can possibly be done; the depth from five to six inches, according to the thinness, or thickness of the staple; these soils being in general so kindly and friable, that trench-ploughing may be dispensed with, particularly if ploughed before winter; but if not convenient to plough it, till late in the spring, I would, in that case, recommend trench-ploughing.

The rotation of crops should be varied with the nature and depth of soil; if a deep fertile loam, the rotation may be,

1. Oats,
2. Drilled beans, or cabbages, or potatoes,
3. Wheat,
4. Turnips,
5. Barley,
6. Grasses.

Where the soil has not sufficient depth, or tenacity for beans, then,

1. Oats,
2. Turnips, or potatoes,*
3. Barley,
4. Grasses;

* Potatoes seldom or ever fail of being a good crop, when made the second crop, after old grass land is ploughed out; the most abundant and best in quality I have ever seen, were produced under those circumstances.

or,

1. Oats,
2. Potatoes, or cabbages,
3. Wheat,
4. Turnips,
5. Barley.

The different ploughings and other operations for beans, &c. will be the same as before mentioned.—The turnip fallow must be well wrought, by repeated ploughings, rolling, and harrowing, and perfectly cleared of *quichens** and other pernicious weeds; and as this is the first fallow after being ploughed out from *old grass*, an *abundant dressing of lime* will be absolutely necessary, to which must be added a proper quantity of dung; from fifteen to twenty cart load per acre, will be very sufficient, if the turnips are drilled from twenty-seven to thirty inches distance, as described in the Northumberland Report; which I would particularly recommend, as the best mode of cultivating turnips, I have ever seen. It leaves the land in the highest tilth, for the succeeding crops, from the advantages of getting two or more ploughings, or horse-hoeings, between the rows of plants, while the crop is growing, over and above the hand-hoeings; by which it derives the additional benefits of ventilation and melioration from the atmosphere, and makes the completest fallow, of any other I have ever observed.

Potatoes should be planted in drills, with three-feet intervals, and the sets twelve inches distance in the rows; they should be ploughed between, and earthed up by a double mould-board plough, at least twice through the summer.

The Consumption of the Crop

Depends a good deal on the situation and nature of the soil; leading them off into an adjoining dry stubble, or grass field, is certainly by far the most economical, and most beneficial for the feeding stock, as they have a regular supply of fresh and clean food, the roots and adhering soil being cut off, and cleared away, as they are pulled. Where the land is in a high state of fertility, this mode is absolutely necessary; for if the turnips were eaten where they grow, the soil would be too much enriched, by the manuring of the sheep; and the succeeding crop of corn would be in great danger of lodging, and injuring, if not entirely destroying the grass-seeds. On the other hand, there are considerable portions of poor, light, dry loams, where there is little risk of the above effects taking place, and where the manuring and

* Couch.

treading of the sheep is of the greatest advantage; on such soils it is proper to eat them where they grow. On soils of a medium quality another mode is frequently practised, of leading off every other ridge, and eating the remainder on the ground; but in this case, as in many others, no general rule can be laid down to be strictly adhered to; a great deal depends on the local knowledge, and discretion of the farmer, and also very often, on seasons. I have repeatedly seen considerable injury done to some soils, by eating turnips on them in wet seasons, instead of receiving benefit, as they must have done, had the weather been dry.

When turnips are eaten on the ground, it should always be with sheep stock; there cannot be a more wasteful and slovenly practice, than consuming turnips where they grow by *neat cattle*.

As the object is to make as fine a tilth as possible, for the grass-seeds, the land should have a sufficient number of ploughings and harrowings after the turnips are off; for this purpose three ploughings are generally sufficient, for giving the requisite pulverization.

The land being prepared as above, and the barley sown and harrowed, then sow the grass-seeds, harrowing them in with a pair of light seed harrows; and if the land be very light and dry, it should be rolled with a moderate sized roller, which causes the seeds to be embraced more closely by the soil, and gives them a better chance for vegetating in a dry season.

It is not necessary to sow the same quantity of grass-seeds on these kinds of soils, as on those of the last class; and as the object is permanent pasture, the grasses should be strictly perennial, as white clover (*trifolium repens*), yellow clover or snail-trefoil (*medicago lupulina*), rib-grass (*plantago lanceolata*), and ray-grass* (*lolium perenne*); these are all the perennials, I believe, that are to be had at the seed shops. Some seedsmen will probably tell you of *cow-grass*, *soft broom*, and *woolly bolcus*. I have known many people order cow-grass seed, and seen it repeatedly growing; but it always turned out the broad-leaved red clover, and not a perennial; the long-leaved red clover (*trifolium alpestre*, or *trifolium medium*) is a perennial, but I suspect, not very palatable to any kind of stock, as I have always observed it neglected wherever found growing naturally on bank sides and the borders of fields.

* It is particularly necessary to be cautious in getting this grass of the true *perennial kind*, as there has of late years been introduced an *annual ray-grass*, which, if possible, should be extirpated; every farmer should grow his own ray-grass seed.

The soft broom (*bromus mollis*) is an annual, and the woolly holcus (*holcus lanatus*), though it is strictly a perennial, and grows abundant crops, yet it is neglected by all kinds of stock, wherever they can get more palatable grasses.

Of the above perennials, I have found the following proportions per acre answer best, for permanent pasture.

White clover	-	8lbs.
Yellow	-	4lbs.
Rib-grass	-	6lbs.
Ray-grass	-	$\frac{1}{2}$ bushel.

Where the soil is very light, or inclined to sand, the quantity of the yellow may be increased, and the rib-grass diminished, as the former grows naturally on sandy soils, and on such, is most certain to continue. White clover and rib-grass grow naturally on almost every soil; I have seen the latter growing with great luxuriance on sandy sea links (downs), and on the strongest clays, and it is always found in great abundance on old pastures of deep rich loam.

In some situations two pounds of red clover may be sown, by way of increasing the pasturage for the first and second year.

When there is any apprehension of the crops "leaping," the land should be pared and burned, and sown with turnips, of which there is not the least doubt of the crop being abundant, and of more value for feeding, than turnips produced from any other manure.

After paring and burning on these soils, I have frequently had two crops of turnips without any expense of dung, as follows:

1. Turnips,
2. Barley, or wheat,
3. Turnips, the fallow limed with eight cart loads of

lime per acre, as early in May as possible: remarkable good crops of turnips are obtained in this manner, worth in any year £5. an acre, and this year, they would have been sold for £7. or 8. The 4th year barley, sown up with clover and grass-seeds as before, and depastured with sheep.

The effects of lime on those soils is astonishing, where they have never been limed before, or have lain long in grass; I would therefore recommend an abundant liming, the good effects of which, will not only be seen in the turnip crop, but still more in the grass which succeeds.

There are different opinions, whether lime should be applied in a quick, or an effete state. I have frequently applied it in both, without observing any decided difference in the effects, and believe it is a matter of little moment, provided it be laid on, in a state perfectly dry and pulverized, and not drenched, or run together with water.

Where lime cannot be had, some other calcareous matter may probably be obtained, and substituted in its room, as chalk, or shell-marl; and clay-marl is peculiarly proper on very light lands.

These kinds of soils come to grass, and cover with a thick coat of plants, the most readily of all others; and if the above directions are properly pursued, there is not the least doubt, but they will be improved. I do not recollect an instance of failure, in the observation and practice of upwards of thirty years.

The management and rotations recommended above, are with a view to have the land laid down to *permanent grass* in the best state possible; but as this class of soils is the best adapted of any other for cultivation, I think it is a pity that any large portions of it should continue in grass, being fully convinced, that it is worth more rent in alternate arable, and grass; and would not only be more beneficial to both landlord and tenant, but also to the public at large, by the very increased produce which the farmers would have to bring to market; I would therefore earnestly recommend the adoption of this system to the owners, and occupiers of those kinds of soil. The only difference in the management, from what is above related, would be, in laying down to grass, where, instead of sowing barley, sometimes wheat might be substituted, and instead of the perennial grass-seeds, before recommended, the principal portion should be red clover, that is, of

Red clover	5 lbs.
White -	5 lbs.
Yellow -	3 lbs.
Rib-grass	3 lbs.
Ray-grass	$\frac{1}{2}$ of a bushel.

The land to be continued in grass for one, two, or more years, according to the fertility of the soil and other circumstances, where it is intended to continue in grass more than two years, a larger portion of white clover and ray-grass should be added, and less of the red clover.

SECTION IV.

Sandy Soils.

What I mean by sandy soils, are those of so loose a texture, as not to adhere when wet, or, which run when turned up, and also blow with the wind.

There are some sands of a very fertile nature, on which I have seen great crops of carrots, of turnips, and different kinds of grain; and I am well convinced, that such lands will pay more in alternate tillage and clover, than in permanent grass.

But there is another variety of sand, of so very barren a nature, that it would be madness to convert it into tillage. I recollect an instance of about sixty acres, the *best part* of a rabbit warren, being ploughed out, under the idea of its being made turnip land: the first crop was rye, and a tolerable crop, the next turnips, which by the assistance of lime, dung, and the *lea-clod* were a *medium* crop; but the *lea-clod* being then gone, the sand was blown and drifted by every wind, and the hopes of ever obtaining another corn crop being entirely given up, the great difficulty was, how to get it covered again with any kind of herbage. After some years this was accomplished, and it now remains a rabbit-warren, and I believe will be such, as long as this experiment is remembered in the neighbourhood; and I am certain, from the number of rabbits sold from this warren yearly, that it is by far the most profitable purpose to which it can be applied.

Betwixt those extremes, there are varieties of other sands, upon many of which I have seen, in moist seasons, good crops of turnips. I have also seen barley and oats grown on these soils, but the most certain crop is rye: this grain will grow with advantage on soils, where no other could be produced.

Within a mile of the place where I have resided for near twenty years, there is a field of this kind of sand of about fifty acres, on which I have seen good crops of turnips. I have also seen the turnip crop (when young) twice blown off this field, which will give some idea of the nature of the sand; it has at different times been sown with oats, barley, and rye, but the rye was always the most valuable crop. About six years since it was laid down to grass, and has continued so ever since; and from the number of sheep which it has depastured, I am clear, that it never paid so much money in tillage, as it has done in grass, for the last six years. The

plants which stand best, or continue to grow upon it, are white clover, yellow trefoil, and ray-grass.

From the above facts, the following conclusions may be drawn.

1st. That rich fertile sands may be employed to the greatest advantage in alternate grass and tillage.

2d. That very barren blowing sands will pay most in rabbit warrens.

3d. That blowing sands which will grow turnips and rye, but no other grain to advantage, will probably pay most in grass depastured with sheep.

SECTION V.

Of Peaty Soils.

In this class I include all those soils of a black colour, and of a soft spongy nature when wet, but which when dry burn readily, and are frequently used as fuel.

The greatest portion of this kind of soil is found on our commons and moors, dispersed through all parts of the kingdom, consisting generally of a thin staple of black peaty earth, on a sandy or clayey *substratum*. The herbage is mostly short heath (*erica vulgaris*), and the land in this condition is of very little value. Of these lands I have seen several thousand acres converted into tillage, and various modes adopted for obtaining the intended purpose. But of all others which I have seen or practised, I would recommend paring and burning, as the best mode of breaking up all such lands, whatever be the depth of soil, climate, or situation, and in every case sow rape for the first crop, and in climates where corn will ripen, oats for the second crop, then fallow for turnips, and give an abundant liming; the spring following sow oats and grass-seeds, of

White clover 8lbs.

Rib-grass 4lbs.

Ray-grass 1½ bushel,

and depasture the first and second year with sheep, afterwards young cattle may be intermixed.

But I have seen great tracts of this kind of land cultivated, where the climate was so inimical to corn, that the crops seldom ripened, and of course the seed and labour were lost; in such cases the following mode of improvement has been adopted with the greatest success;

1. Pare and burn for rape,
2. Turnip,
3. Turnips,
4. Grass.

The crops of both rape and turnips should be eaten where they grow, by sheep, which not only enriches the ground by their dung and urine, but considerable benefit is derived from their treading, which is of the greatest service, in destroying or rotting the fibrous roots, and which, at the same time, gives the soil more compactness, firmness, or density. The quantity of lime should be at least eight cart loads to an acre, laid upon the first fallow. Two or three ploughings and harrowings will make this fallow sufficiently fine for sowing turnips broad-cast, which should be as early as the first week in June. For the second crop of turnips, one ploughing will be sufficient, and one for the grass-seeds the spring following, which should be sown the beginning of May, in the proportions before-mentioned, harrowed in, and rolled afterwards with a heavy roller. No kind of stock is to be suffered to come upon it till the next summer, when it should be depastured for that, and the year following, entirely with sheep; afterwards with sheep and a few young cattle, or horses intermixed.

Lands, which in their original state of heath were not worth one shilling an acre, have been improved by the above means to be worth five, six, or seven shillings an acre in grass, but on which various kinds of corn crops were tried, but never to advantage. Unless there were indeed a certainty of the climate being favourable to corn, and the crops ripening well and in good time, I would never attempt to sow corn on any such soils. In the best situations it is a hazardous game, and the crop is rarely worth more than the expence of seed and cultivation, excepting only the first or second crop of oats, which are always by far the best; on which account, the more seldom these soils are ploughed, the better, after the heath is destroyed. When they are laid to grass, they should so continue until they begin to cover again with heath, which is often the case; it happens sooner or later, but the interval seldom exceeds twenty years.

It may be objected, that, as these soils cannot be employed in growing corn to advantage, they are not worth ploughing out;—to this I answer; that though they may be improper for corn, yet, if by ploughing, liming, &c. they can be made to produce grass, which will carry one sheep an acre, instead of one sheep on five or

six acres of heath, it is certainly of importance: sheep and cattle in that case can be bred and reared in those situations, while the more fertile soils and more favourable climates (now used for that purpose) may be converted into tillage, and employed to greater advantage, as well to the occupier, as to the community at large. Our markets must be supplied with mutton and beef, and wool and leather, as well as with corn; therefore if our moors can be made to grow *grass* instead of *heath*, it will certainly be of national benefit.

When this kind of soil is found of a considerable thickness, growing different species of *carex* rushes, cotton-grass, and other aquatics, and marsh plants, with little or no heath, it is of the best quality, and most likely to repay the expences of improvement. The first operation is draining, and this must be effectually done, before any other can properly take place. As soon as the draining has had time to take effect, and the land has got sufficiently firm, to carry horses, it must be then pared and burned, the thicker and the more ashes the better. Plough very thin, and sow rape in the middle or latter end of July to stand for seed. As soon as the rape is off, plough it immediately, and let it lie in this state all the winter; next spring sow oats, the year after fallow for turnips, and give it an abundant liming, eight or ten cart loads per acre, at least. The spring following, sow oats and grass-seeds, as before; depasture the first and second year with sheep, afterwards it may occasionally grow hay. I have seen excellent meadows obtained in this manner, which grew large crops of hay, by being sometimes manured with dung or compost, made of earth, dung, and lime.

Grass-seeds.

The best mode of ascertaining whether the grass-seeds should be paid for by the landlord or the tenant, will be to proportion the expense according to the interest each party has in the produce: if the tenant has only one year in his term, or only one year's eatage of the new grass, he should pay one-third the price of the seeds, and the landlord two-thirds: if he eats the grass two years, he should pay two-thirds, and the landlord one-third; and if he eats it three years, he should be at the whole expence.

In respect to what increased rent a tenant should pay, on being allowed to plough out any grass land, from which he may be debarred by his lease, I am afraid no general rule can be laid down, but what may be liable to numberless objections, as

the price of labour, and the price and quantity of produce vary so much in different districts; for instance, in those countries where they use four or five horses and two men to each plough, the expence of ploughing an acre cannot be less than ten or twelve shillings, while in others they use only two horses and one man, which plough an equal quantity in the same time: in some places an acre of corn can be reaped for six shillings, in others not under double the sum. In some counties the price of corn is generally a shilling a bushel higher than it is in others; I am therefore clearly of opinion, that this matter can only be determined with propriety, by people who have a local knowledge of every circumstance, as the quality of the land, price of labour, markets, &c.; of course no method appears to me so proper, as referring it to two indifferent persons in the neighbourhood, one named by the landlord or his agent, the other by the tenant, and if these two cannot agree, let them choose a third, as umpire. If this mode be adopted, there is little fear but that justice will be done to all parties, and this is therefore the most likely means of producing general satisfaction.

26th January, 1801.

No. XVI.

An Essay on the best Means of converting Grass Lands into Tillage, &c. &c.
By Mr. J. Bridge, of Winford, Dorsetshire.

THERE is no operation in agriculture which requires greater nicety, and in which the skill and integrity of the farmer can be displayed to greater advantage, than the converting of grass lands into tillage, and again restoring them to their original state, without exhausting the soil. Maiden lands being in general more productive than the ancient arable, and a smaller expense being requisite in their cultivation and management, the farmer is always eager to break up such lands, but it often happens, that either from a covetous disposition, or from the shortness of his term, he leaves them in a state absolutely exhausted. Hence the landlord, for the purpose of preventing such waste, restricts the tenant to occupy in tillage those parts only of his estate which have been usually in tillage, and which cannot, if the covenants generally contained in leases be complied with, be rendered materially worse. Yet the quantity of grass lands in this kingdom, which may properly be employed in tillage, is great indeed; and if a due mode of management is observed, the land will not be injured, but improved, and the increased produce will be so abundant, as to remove every apprehension of a future scarcity; and here I would by no means recommend an indiscriminate breaking up of grass lands, as the rich pastures and meadows, if once converted to tillage, will not for a long course of years, perhaps not for ages, resume their former luxuriance. The lands which promise the greatest advantages are the coarse and rough pastures, where the soil is moderately good and dry, and which can be covered with some one of the various sorts of marle before they are broken up. This pasture forms a considerable part of the *ewe-leases* of the county of Dorset, to which my observations have been chiefly confined. That my meaning may not be misunderstood, I will repeat, that it is not my intention to recommend a general breaking up of *ewe-leases*, or of any part thereof, where the grass is sweet and much fed on by the sheep, for such land cannot fail of being injured by tillage; with respect to the rough pastures the case is very different, as I have learned from actual experiments.

About fifteen years ago, perceiving that a part of the *ewe-lease* which I occupy was coarse and very mossy, and not worth more than 7s. 6d. per acre, and actually prejudicial to my sheep, I resolved, with the permission of my landlord, on breaking it up: with this view I fenced off forty acres, and, as the preparatory step, covered the whole with white marle, commonly in this country called chalk, at the rate of sixty good cart loads to each acre. This marle or chalk I found at two feet beneath the surface. The expense, which was about £5. an acre, was so low in consequence of the marle being raised at a small distance from the land on which it was spread. The land is of a coarse, sour, flinty quality. In the course of three years (during which time I still used the land as pasture) the marle having been regularly spread over the ground, was grown into and become part of the soil: in the autumn of the third year I first broke up the ground, and in the following spring sowed it with tares, which were fed on the same land. In the succeeding autumn I sowed wheat, which turned out to be an abundant crop, upwards of thirty-eight bushels per acre. In the third year I sowed turnips, part of which was fed on the ground, and the other part was stacked for the ewes and lambs on the adjoining pasture lands. I had two reasons for stacking the turnips on the adjoining pasture lands; one was, the fear of their being destroyed by the frost in the winter, the land being high and much exposed; the other was the crop being abundant: if the whole had escaped being rotted by the winter and fed on the land, would have made the next crop so luxuriant, that it must have been lodged, and spoiled the broad clover, which was to be sown with it. The fourth crop was barley with broad clover, which in the fifth year I mowed for hay; the produce of both was very great: after the broad clover in the sixth year I sowed tares, which I fed on the same and. In the seventh year I had an excellent crop of wheat, but not so good as the former. In the eighth year I sowed turnips, which I managed as in the third year. The ninth year I sowed the land with barley and seeds, for the purpose of again laying it up; the seeds used were one bushel of Devonsbire ray-grass, ten pounds of marle-grass, five pounds of white Dutch clover, and five pounds of trefoil to each acre. This proportion of seeds has produced the finest grasses, and the herbage still continues quick and luxuriant. Three years have elapsed since the field was sown up, and it is now well worth twenty shilling per acre. A folding over, once in two or three years will be necessary, and if it is suffered to remain in pasture, no further dressing will be wanted.

From the success attending the first experiment, I was induced to try a second, by

converting into tillage twenty-two acres more of another part of the *ewe-lease*, where the herbage was equally coarse and mossy, in a similar way; the land was a strong, sour, flinty soil. The result promises to be equally beneficial; it has been laid down to grass for one year, and the grasses in the ground appear full and good. All the advantages that have arisen from this mode of husbandry, I attribute to the copious marling, for the three years before the land was first broken up, which having time to sink into, and become part of the soil, not only gave it additional strength and vigour for bearing the several crops, which have been taken from it, but has tended to give that sweetness to the herbage, which it now possesses. What is also of some consideration is, that the land being mellowed and softened by the marle, was ploughed with half the strength, which would otherwise have been necessary. Besides the advantages derived from the crops, I have now the pleasure to find my land three times increased in its value. Most of the *ewe-leases* in the County of Dorset, the *substratum* of which is white marle or chalk, and where the sheep will not feed by reason of the coarseness of the grass, may be equally improved by the same mode of husbandry; but great care should be taken that the land be first properly dressed, for otherwise the tillage will only impoverish it. In most situations in Dorsetshire, the white or blue marle may be had; but should a case occur in which no sort of marle can be obtained, then I would recommend that the land be well dressed with lime, at the time of sowing the last crop of turnips, pursuing the mode of husbandry before laid down, and which I have found productive of so much advantage. The lime-dressing will add a stimulus to the land, and will so sweeten the herbage, that the dung of the sheep feeding on it will be sure to keep it in high condition, if such sheep are not permitted to be folded off; but that there may be a certainty of the lands continuing in the same vigour, I would recommend a folding on it every two or three years, and that some manure be devised for the supplying the want of the fold, which the ancient arable lands may feel. As farmers in general are too apt to confine the fold to the arable lands, and for an obvious reason, because the fold furnishes a dressing which is always at hand, and costs him nothing, the lime-dressing for the turnip crop should be at the rate of about 150 bushels to each acre.

After the land is sown up, feeding for the first year is absolutely necessary, and if it is intended for permanent pasture, it should not be mowed for many years to come, as marle-grass in particular, if once mowed, will not remain in the ground half

so long, as it would otherwise do, if fed. The cutting of grass cannot fail of being injurious in itself, but it is doubly so if permitted to be removed from the land. The luxuriancy of the pasture will be in a great measure destroyed; on this account I should require the land to be constantly fed, till it had required the thick and firm sward of ancient pasture. If the fold cannot be obtained, then a dressing of dung, ashes, or lime will be required in the course of two or three years, after the land is laid down; after which period no manure will be required, provided the land is not tilled again, nor mowed, the feeding of sheep and cattle being sufficient to keep it in heart.

If the land is wet, draining is indispensable before it is broken up: this should be under-ground drainage with stone or chalk; the drains should be set thick, and the covering within six inches of the surface, should be small stones, flint, or gravel, if such can be conveniently had, if not the best of the soil, dug out of the trench, may probably answer the purpose.

The ground must be made quite dry, otherwise any manure which may be laid thereon, will be thrown away; but if the *substratum* be clay, and the ground though wet, has nevertheless a tolerable herbage, I would not recommend it as proper ground for tillage, for there will be a great difficulty to give it so good a sward, as it had before. If it is coarse and mossy, ploughing will be advantageous after it is completely drained; it should first be covered, if possible, with marl three years before it is ploughed, and if marl cannot be procured, a lime dressing will be necessary, before it is sown with seeds. The course of crops should be

1. Tares,
2. Wheat,
3. Cabbages,
4. Oats and seeds,

I mention oats, because strong clay lands are more adapted to that kind of grain than barley.

Having had no experience with respect to the paring and burning of land, I am not prepared to give a decided opinion on that subject; as a general system I am not friendly to it; but it strikes me, that the process would not be injurious if the land is in a very rough state, full of briars, furze, &c. The proper mode then, I think, would be, to pare or grub up with these incumbrances, as little of the soil as possible: the ashes produced without burning the soil, could not fail of adding

much to the goodness of the crops. A dressing of lime will be necessary before the land is again laid to grass; if the land is wet and but of an indifferent quality, then two crops of corn will be sufficient, but if the soil is dry, kindly, and fit for turnips, then I should prefer four crops of corn, with a crop of broad clover, and two crops of turnips, between the white crops. Tares I always recommend to be sown first, after the land is broken up, and fed on the same; then wheat, turnips, barley, broad clover, after which tares will succeed, to be fed as before; then wheat, turnips, barley, or oats (as most suitable to the land) and seeds. If the surface of the land is burnt, I have reason to believe that it will never become a good permanent pasture again; but a full discussion of this subject must be left to those who are more conversant with it.

The first ploughing of all grass lands should be as thin as possible, so as to turn the furrow well.

All loamy soils are fit for turnips, and if broken up with an intent of again being laid to pasture, then the course of crops which I raised on my own ewe-leaze I should most strongly recommend, with this difference only, that flax should be the first crop instead of tares. Before the land is broken up, a dressing of marle is desirable. The course of crops will be (as before observed) flax, wheat, turnips, barley, broad clover, tares; or, according to the farmers choice or necessity, wheat, turnips, barley, and seeds.

Sandy lands in all their varieties require to be frequently tilled; in general they do not produce good pasture, and for that reason should not remain in pasture more than two, three, or four years, before they are again broken up. If kept as up and down lands they will, under a good course of husbandry, be very productive. They generally bear good turnips, barley, and young grasses; some sands will bear good wheat; in this case wheat should be sown on ley, turnips should follow, then barley and young grasses.

Warrens and heaths do not promise much, unless they are dry; those that are, might be tilled to great advantage under a proper course of husbandry. Wet heaths cannot be supposed to pay for draining, but their produce will be considerable, if planted with firs or forest trees.

On the downs, where the chalk is near to the surface, no profit can be derived from ploughing them; but if there is a soil six or eight inches deep, before the chalk makes its appearance, they may be employed as arable to great advantage. Four

crops of grain may be taken, with two crops of turnips, and the like number of tares, between the white crops. If the land is mossy, and the pasture sour, it should unavoidably be covered with chalk, three years before it is first ploughed; the crops will not only be much more productive, but the grass will be more luxuriant, and the herbage much sweeter when again laid down to pasture.

In all the cases above enumerated, the greatest care should be taken that the land be laid down in a high state of cultivation, full of manure, and clean from weeds, particularly couch-grass; in order to obtain this desirable end, there must be green feeding crops between the white crops. This succession will put it out of the farmer's power to injure the land, provided he is either obliged to marle before the first breaking up, or to lay on manure for his turnip crops. The advantage may not be so great to the occupier to lay on his manure for the green crops, as it would be for his white crops, but the land itself will be more improved, and the landlord must ultimately derive an advantage.

On laying the land to grass, one bushel of Devonshire or Percy's ray-grass seed should be sown in each acre; this seed has the advantage of being perennial, but the ray-grass generally sown in the counties of Hants, Wilts, and Dorset, is only annual. There should be added ten pounds of marle-grass, five pounds of white Dutch, and five pounds of trefoil; and as the land cannot be filled too full of seeds, three pounds of white suckling, as a superabundant store, would tend to improve the pasture. By sowing different sorts of seeds, the herbage is good during the whole year; as the trefoil and ray-grass flourish from the early part of the spring till midsummer, it is afterwards but of little value: the marle-grass is in its greatest perfection from Midsummer till Michaelmas, when the white Dutch and white suckling come in, and are most luxuriant from Michaelmas to Christmas. If the winter is mild, the ray-grass and trefoil begin to vegetate again soon after Christmas.

The course of husbandry pointed out by the preceeding observations, and which has had the test of my own experience, requires that the occupier should have a term in the land, not less than twelve or fourteen years. As the consent of the landlord will be necessary, and as it cannot be expected that his consent will be obtained without some advantages to him, it is desirable, that some certain mode of estimating it should be laid down.

Taking the rough *ewe-leases* of the county of Dorset, as the basis of my calculation, I cannot think that the farmer can afford much, if any, advance, the first seven

years; for if the rent is immediately increased, he will be checked in his exertions, especially if he is previously to spread on his land a copious dressing of marle, so that it may remain in a high state of cultivation, when sown to grass, for a permanent pasture.

The seed must be provided by the farmer himself, for I do not perceive any advantage on this head, from the interference of the landlord; he will do well to see that the routine of dressing and crops be regularly and strictly adhered to, and proper seeds sown when the land is laid down to grass. After the first seven years, an additional rent of five shillings per acre will not be thought too much, with the probability of the land becoming still more valuable, at the conclusion of the term; other advantages will accrue to the landlord, as well as to the tenant, from the increased tillage. The straw will furnish more manure, there will be an additional supply of reed for the buildings, there will be more employ for the labourer, the poor rates will be lessened, and the whole country will be benefited by a greater plenty, and a diminished price.

No. XVII.

An Essay on the best Means of converting Grass Lands into Tillage, &c. &c.
By Jos. Wilkes, Esq. of Measham, Derbysbire.

MY LORD,

AGREEABLY to the resolutions of the Board of Agriculture, which I had the honour of receiving from you, relative to an inquiry into "the best means of converting grass lands into tillage, and returning the same into grass after a certain period," I beg leave to submit the following observations for their perusal.

Grass land, of the first and second rate quality, is so valuable to the owner and community, by a great production of beef, mutton, milk, butter, cheese, pork, wool, hides, tallow, &c. that the value of its produce would be much decreased by the plough; if it be strong tenacious soil, it cannot be restored to its former quality in less than thirty years; land of a deep rich light soil will not return to its original quality, in less than fifteen years, upon a system of good management, as that of an ameliorating crop between two white crops, such as the land is adapted for, with fallows and dressings of lime.

Land which is capable of artificial watering is too valuable to be ploughed.

Land situated near large towns, and other situations for cheap improvement, may also be made too rich for the plough, but not for grass.

There is a sort of heathy and moory land, that produces scarcely any keep for sheep or cattle; such lands on the north of Trent, in high cold situations, I would also advise not to be ploughed, but to lay on such rough turf, eighty quarters of quick lime per acre, which will destroy that turf, and produce a rich one, which will feed either sheep or beast.

All the aforesaid lands are a small portion of the whole of the kingdom; therefore great quantities of land of the third and fourth rate quality, which alternately produce grass and corn, may be varied in their culture, according to the demand of the kingdom. A very great portion of this land is restricted from the plough, and at the present time furnishes the market with meat, not more than two-thirds fat.

On land of the first and second rate quality, there is a considerable injury sustained by ant-hills; the best mode of cradicating which, is to pare them off, and mix them with unslacked lime. The heat completely destroys the insect, and it becomes a capital top-dressing for the turf; it may be turned over, after a week or ten days, and then would be ready, as suited the land and convenience of the occupier, to be spread on the surface.

Where lime does not exceed four shillings per quarter, it would doubtless answer, to lay it on the best turf land in the kingdom, from ten to fifteen quarters per acre.

I have witnessed land of the best grazing quality ploughed, when it would feed a bullock of one hundred and thirty stone per acre for the summer, or a cow to make five hundred weight of cheese per acre for the same time, the first and second crop of which were chiefly straw with very little corn, from a half to a fourth less than a common average crop; these were followed by one and two productive crops full average. This left the land very foul, so much so, as to require two turnip fallows to clean it before laying down; this land has been in grass about ten years, and has been regularly improving every year by grazing, and may arise to its original value in four or five years more. So long as the artificial grasses continue in the land, they will not feed more than five or six months in the year, whilst the same land, with its old turf, will feed for eight or nine months. This, experience has sufficiently proved to me, both in my own estate and in that of my neighbours.

Upon land of the middling quality, or the third and fourth rate, the artificial grasses are a better pasture, especially in the spring months, than their own natural grass.

The greatest quantity of land in the kingdom comes under the third or fourth quality, or middling sort, a considerable portion of which is in grass, and restricted from the plough, and will not produce from a fourth to a half the quantity of beef, mutton, &c. as the land of the first and second quality, and yet under a system of good husbandry would be equally productive of corn, very generally so for the article of wheat, and may be brought again into grass without injury.

The light soils of this sort from old turf, should have for their first crop, oats; then, as an anchoring crop, turnips, potatoes, or peas; after which either wheat or barley, to be laid down with red and white clover and rye-grass; if wheat is intended on the clover roots, then red clover only.

The stiff cold land to be pared and burned from the old turf (which is the quickest

and best preparation for wheat) for the first crop. If not pared and burned, then beans; wheat for the second crop after beans, then vetches, with fallow and wheat again, and laid down as in the light soil; though clover roots on stiff soil are not so eligible to break up as roots on light soil for wheat.

Rich sandy turf land to be sown with oats the first year, the next with carrots as the most valuable crop; and for inferior sands, turnips to be cat on the ground, and then laid down with the same grass-seeds as above described, with barley, except on stony rocky bottoms, in which case it should be laid down with sainfoin.

The heathy land in the south part of the kingdom to be ploughed thin, and burned, rather than pared and burned. Lime is a good manure to follow burning, in any case; oats to be the principal crop on this sort of land, until it has had plentiful dressings of lime after the first crop of oats, to be fallowed with either turnips or potatoes, and laid down with oats and seeds as before; the clover may be broken up for wheat where the subsoil will permit.

Peaty land is of various qualities; where it runs from four to ten feet deep, it is very valuable to dig out to burn for manure, and where at a greater depth, if well drained, would become useful land, either to be in tillage or in grass.

In order to render cold clays productive of fair average crops, I consider the burning system as the most certain, with the least expence, if the situation is such that coals may be had at a price not exceeding ten shillings per ton, or faggots in the same proportion, to plough thin, and burn with that assistance; but if these articles are dearer, I would recommend the paring and burning, which will insure a good wheat crop; dressing of lime afterwards, with beans, oats, clover, &c. Lands of this description must have whole summer fallows, unless the drill and horse-hoe system is adopted.

Light sandy soil, or rocky mountainous situations, where the crop is extremely uncertain, should not be ploughed, as the expence of cultivation and seed often amount to the value of the produce; such soils should either be planted with trees adapted to the respective situation, or remain for sheep-walks; but all such land may be rendered more productive, and the grasses made better by top-dressings.

The depth to which soil should be ploughed, depends much on the *substrata*, &c. in general from three to five inches.

Turnip crops should be cat upon all light, sound, sandy soils.

Grass-seeds should be found by the tenant, though in certain cases paid for by

the landlord, where the tenant quits, before he has derived any advantage from the seed crop.

Artificial grasses in the first year to be catch off, rather than mown, provided fodder can be procured from meadows.

All soils previous to being ploughed, should be well drained, either by close soughs, or large open drains; close soughs, set with brick or stone, are the most preferable on account of durability: turf soughing and the mole plough have in many cases great advantages.

Lime is a valuable dressing for all land made sound, but more beneficial if mixed with coal-ashes, paring of ditches, banks, &c. and mixed whilst the lime is in an unslacked state, after burning; in dry seasons a little water may be added at the time of mixing.

Burning land, as an improvement, seems but little understood. I am convinced from long experience, that strong, middle, and light soils, are all improved by burning; the strong soil in particular is pulverized, and rendered more fit for the production of vegetables, than by any other mode of improvement. Coal-pit banks have been rendered productive by burning the mining earth, with the refuse sleck, which otherwise would have remained unproductive, with any other mode of management; the best mode is to plough, and gather in heaps of about one ton each, properly distributing the refuse sleck from such banks in the burning, and then spreading the whole over the field so ploughed; there is less hazard from insects, and the land is kept much cleaner; it is also a good top-dressing for grass land.

The drill and hoe system, if generally adopted as it might be in all cases, except in that of first turf, would be of infinite advantage in the saving of seed, increase of crop, as well as a certain mode of keeping the land clean.

With respect to the laying on manure, I have experienced, that dung carried from the stable-yard, at not more than three days old, and laid directly on the land both in summer and in winter (as in the one case it prevents the land from parching, and in the latter from starving) has an advantage of 20 per cent. over that dung which is stacked from nine to twelve months.

The two crops of potatoes and Swedish turnips have not been attended to by the farmer, with that care, which their evident utility demands; the advantages of the former, as an ameliorating crop to tillage land, and their use in feeding horses and

all cattle, as well as at the table, are too obvious to need enumerating; the latter, as well as being an ameliorating crop, possesses as many advantages to cattle as potatoes, and are excellent at the table, with the peculiar quality of being proof against the most severe winter, and open a source of winter food to the farmer, the value of which cannot be estimated. The best mode of cultivating these turnips is by sowing early in May, and transplanting, when the land is ready; they will flourish upon stiffer soils than the common turnip, and the tops are also preferable.

Irrigation is obviously the most efficacious mode of providing a quantity of winter food at the cheapest rate, yet it is not practised by farmers in general on a large scale, where opportunities offer. The course of streams being generally the division of property, the deviation is attended with difficulty, unless a mutual advantage can be derived, and there are few instances where the advantage is the same on both sides. Water mills are often an impediment to the deviation of a stream for the purposes of irrigation, where a tenth of the advantage to the land would pay for extra expences in wind or steam mills.

The too rapid inclosure of waste lands must add to the difficulty, in all years of scarcity, by the additional quantity of seed required; as in the last year the quantity of wheat sown is supposed to be one-fourth more than usual, which has no doubt added to the price of that article. What also increases the difficulty is, that in many counties, but little attention has been paid to the drilling or dibbling system on land sown with wheat, which is forced out of its regular routine of husbandry.

Smithfield is an admirable school for those who seek information on the subject of feeding and breeding. The cattle brought to Smithfield, on attentive examination, are found to be deficient one-third of the weight of meat, which the same cattle would produce to the market, if the breed was sufficiently attended to, and brought from land the best adapted for feeding.

I have no doubt, if the land were properly and judiciously cultivated, by allotting to each land that routine of crops, &c. of which it is best calculated to produce the most, with a judicious application of the manures with which the country abounds, the advantages which a canal conveyance gives to such manures, with the proper progressive inclosure and cultivation of waste lands, that the kingdom would produce twice the quantity of provisions it now produces.

I have in the several cases of watering and burning, increased the value of the land six times beyond its original value.

Public roads formed on the true concave system, together with iron railways of the best construction, added to canal conveyance, and the more frequent use of oxen in husbandry, cannot fail to increase the quantity of provisions at market, by lessening the number of horses required both to cultivate the land and to convey merchandise; and that advantage would still be increased, if all horses were soiled in the house.

The laudable endeavours of the Board of Agriculture, and the Smithfield Society, will furnish the occupier of land, with a fund of information for his guidance, and which, if it be not attended to by the tenant, may yet be of infinite service to such noblemen, as wish to have sensible well-informed men to point out to the occupier, what mode of management in different situations shall be adopted.

My Lord,

I have the honour to be, &c. &c.

No. XVIII.

An Essay on the best Means of converting Grass Lands into Tillage, &c. &c.

By W. I. Ans, Esq. near Launceston, Cornwall.

THE Author of the following short observations, most humbly submitted to the Board, in consequence of their advertisement, feels himself very deficient in point of abilities; and (if this had not been the case) in want of leisure from other avocations, to indite any thing like a regular "essay" on the subjects proposed; yet he is desirous of stating some circumstances, and proposing some means, as his *mite*, towards obtaining part of the end desired, which many persons, though of superior abilities, in the part of England where he resides, may, not improbably, feel less inclination, or still less leisure, to attempt.

The soils which have occupied a considerable part of my experiments and observations are clays, various loams, moory soils, with rough moor-stone,* and other bottoms. Of such consists much of the country, far and near, around me in Devon and Cornwall, mixed however with a variety of other soils well adapted to pasture and tillage: of such too will, I apprehend, consist the greater part of the inclosures of *forests*, &c. &c. throughout the kingdom, proposed to be added to our present stock of tillage, as necessary to future provision for our certainly increased and increasing population.

The custom of paring and burning is *here* in very general practice. I once was, not singularly, misled by *speculative* writers on husbandry, (who I fear have much to answer for) to think, that the process of *burning* caused a lasting injury to the earth, by reducing it to a *caput mortuum*, unproductive of corn, unless by being plentifully mixed with manures added to a large portion of unburnt earth; and productive of *moss* much earlier than this evil would otherwise return after tillage. I therefore caused a small field of four or five acres to be fallowed, beginning late in the winter, and, after two or three ploughings only, tilled it to wheat, though advised by my neighbours to the contrary, some of whom had suffered by the like experiment. The soil was a light loam, well situated, and the result rather beyond

* Granite.

an average crop. This I did not expect; but had presumed the loss, if any, herein would have been repaid by an unusual crop of grass (after the process of tillage) continuing free from *moss* for some years beyond the common period of its return. I found myself much mistaken, however, even in this point, and afterwards much more so in corn, when, encouraged by the past chance-crop of wheat, in the following year, I extended the same practice to an adjoining field of twice the size, and thence to a third, in both of which the crops of wheat failed, in like manner as had happened to some of my neighbours, on a much more extended scale, and, consequently, attended with a still greater loss; the moss in all the cases returning nearly at the usual period. Hence all my fellow-sufferers by fallowing, and myself, have totally abandoned this practice, and stick by the more general and ancient one of *burning*. It was agreed, that the cause of failure in the wheat crop, after fallowing, arises chiefly, but not entirely, from the soil being rendered thereby much finer and freer, than by our usual mode; in consequence of which, the growing seed, although it appears at first to flourish, is soon washed by our mixed tempests of wind and rain from the Western Ocean, by which the finer parts of the soil are dissolved and carried off, to the great and lasting impoverishment of the remainder, and the roots of the wheat appearing near the surface before the spring, soon wither away. Other causes there are, which operate to the disadvantage of fallowing on some of our best soils, and fullest of manure, even in sheltered situations, one of which is the rapid growth of grass and weeds amongst our corn, partly, perhaps, owing to the warmth and salt of our sea-air and mists, which fallowing fails to subdue, and these impeding the growth and rooting of the wheat, in spring, continue to advance with, if not before it.

However more complete fallowing may benefit lighter soils, which it might be unnecessary or improper to burn, where the vegetation of grass and weeds is not so luxuriant; I am assured it never would operate to like advantage with burning in nearly three-fourths of the two westernmost counties. I am persuaded also, that it might be practised to advantage on Hounslow, Bagshot, and similar heaths, and on various other soils, in very many parts of the kingdom, where yet it never was tried. This mode is generally and necessarily followed on all ground, which has been in pasture for some years, termed here "old ground," yet the less time it has been so, the less quantity of the earth is usually burnt, and if the tillage be renewed within a few years, it may be done to advantage, either without burning on the first or second

years clover, or by carefully harrowing out the roots and tufts of grass or weeds, leaving no more earth than casually adheres to these, which is the usual and best mode preparatory to burning and subsequent tillage.

The manure of great part of Cornwall, and some parts of Devon, is *sea-sand*, used at the rate of from fifty to one hundred and fifty horse teams (weighing about two hundred and fifty pounds each) to one acre, the carriage of which may be estimated at one penny the horse team per mile. In the other parts, lime is used, in quantity from forty to fifty bushels (of twelve gallons each) per acre, and at the price of as many shillings at the kiln, added in both cases to the dung of animals housed in winter. The sand or lime is usually mixed with earth or compost from the adjoining roads or brinks, or other parts of the field designed to be tilled, the whole again mixed and spread with the beat-ashes on the surface. This should be followed, and generally is so, betwixt the new and old Michaelmas, by a shallow ploughing in ridges of eight furrows, if on clay bottom, or any level or wet soil, the intervals cleansed with our sharp-pointed shovel, and the earth therein mixed with seed carefully distributed on the ridges. The furrows of the ridge narrow, and left by the plough in an inclined plane, whence it happens that the seed wheat descends, together with the manure, for the most part, in the opening, and becomes more secure from storms, and better rooted than otherwise it would be. The ground is to be broken by the band-mattock, and left in a somewhat rough state. In a dry spring this is sometimes smoothed by a light roller of wood, with the intent of further sheltering the young shoots from storms, but seldom horse-harrowed, unless in very dry fine soils; the seed being thus left undisturbed, springs up in lines at nearly equal distances from each other, and from these careful processes a sure crop usually follows: as in the last season, when the wheat crop was never better saved, and even in quantity exceeded an average one, though farmers are unwilling to acknowledge it, and many suffer themselves to be misled by hastily taking their information on trust.

Respecting the further results of burning, I beg leave to remark, that there is often found on the tops of the burnt heaps, which we term "beat-burroughs," a white substance of a strong salt nature, mostly so when mists, or light rains, condense, without extinguishing, the fires. Knowing nothing of chemistry, I can no otherwise define this salt than by adding, that it operates like a mild caustic on the tongue, and, I presume, may tend considerably to promote the growth of the wheat crop.

It is well known and experienced here, that these "beat-burroughs," though soon covered with moss after the fire is extinguished, will nevertheless bear, unmixed with any other substance, a good crop of turnips, sown on the lower parts thereof. Were the before-mentioned facts more generally known, it might tend to preserve the public from being troubled with idle declamations of ignorant persons against the practice of burning, in any case whatever. Ill founded prejudices, therefore, should not prevent the experiment of burning being made, in such parts of the kingdom where a whole year's produce is alternately lost by fallowing, to the community, a practice which seems to many indelensible.

Our course and number of crops should be adapted to our various soils; but the surest mode, on much the greater part of the soils I have before described, would be, after the wheat stubble has been ploughed twice, once before Christmas, and again in February or March, if for barley, a crop of barley or oats, according to the poverty or richness of the soil, with which should be sown clover or rye-grass,* or both. The first alone where the soil is rich, both where middling, and rye-grass alone in the coarsest. Unless the soil be both dry and good, all kind of cattle should be excluded from the stubble: the clover mowed (I presume this will be found advantageous in every country where meadows do not abound) and the aftermath sparingly depastured with sheep, or light-bodied bullocks only. By this means the soil soon becomes covered with the best herbage; for the tread of heavy cattle on new ground (of which the *stratum* is clay or stiff loam) at once removes the roots of clover from their natural position, bruising and injuring these, and leaving a pit, which by retaining cold water in winter, nearly, if not effectually, destroys the whole. Crops of potatoes and turnips are in some parts of these counties tilled on the wheat stubble, to advantage; and my own observations, strengthened and confirmed by similar remarks from some of my neighbours, are in favour of the practice, of not suffering crops of corn to follow each other, as worthy of imitation; yet our farmers continue (too generally) to follow the ancient custom of wheat, barley, and oats, successively. Of late years, indeed, they have abated of the second crop of oats on coarse ground, considering now properly, and observing, "that the manure turned under furrow when the wheat is sown, and returned to the surface by ploughing for the succeeding crop (say, oats on coarse ground) leaves the manure again on the surface, where it ought to remain for the benefit of the new pasture."

* Called here "caver."

The moors in general, with much of the inclosed lands in this country, are composed of a light soil uppermost, consisting probably for the most part of decayed vegetables, mixed with spar,* (a hard white stone,) with clay, within a few inches below. Where the bottom is of granite, which happens chiefly, if not entirely, in elevated situations, there, clover is not expected to thrive, nor does corn ripen kindly unless in such warm dry summers as the last. It is much to be feared, therefore, that those sanguine writers, &c. on husbandry, who count so largely on acres of coarse ground yet to be inclosed, and added to the stock of tillageable land in this kingdom, have had but little experience, or are superficial observers, of the laborious attempts which even experienced farmers have occasionally made in tillage, at such heights on the fens and moors of these, and other counties, but which seldom repaid their cost and toil. At the height of sixty fathoms, however, or upwards above the sea, on a moor covered with furze, or the worst of herbage, where the light soil I have before described was bottomed by clay, manured by from fifty to sixty horse teams of unmixed sea-sand only per acre, I have lately known an extraordinary produce of wheat and oats; the rent of this ground, on an average, was forty shillings per acre, per annum, for three successive crops, of wheat one, and two of oats, with the last of which rye-grass was sown; yet, within a few miles of this spot, though on a still much more elevated situation, the upper soil, better to appearance, and as long as the former out of tillage, with bottoms of moorstone, or spar, or with a few veins of clay, the land would not let for half the price per acre; for here the wheat crop, though seeming at first to vegetate well, seldom ripens so as to insure a crop, at harvest, and to repay the expence of tillage upon the whole.

At what height above the sea corn may generally be presumed to ripen well, allowing for different soils and aspects, I am not qualified to determine; but may be allowed to guess, at little more than one hundred fathoms, if so much; and if this be the case, I submit, that those who count on the additional acres of new tillage, before alluded to, may from these and other causes of sterility, abandon at least one-half of their imagined quantity; and concerning the remainder, practical farmers will inform them, that "whilst the stock of tillage is suddenly or largely increased in new inclosures, it must necessarily be lessened, *pro tempore*, in the old, though with advantage to the latter by rest."

Concerning moor lands, it may be worthy of remark, that similar soils, situations,

* Quartz.

and crops, to the best I have above described, would not have produced to the land owner half the rent per acre, if manured with lime instead of sea-sand. This difference in rent, therefore, arises solely from the cost of lime. I apprehend one practice here is rather singular, and adapted only to the moor soil, which after burning, producing neither grass or weeds amongst the wheat, induces some farmers to sow (by passing carefully through the furrows about Midsummer) turnip seed by broad-casting it *over* the wheat ridges. This I have known to produce, though rarely, a valuable crop of turnips; better soils would not thus produce it, nor even after harvest, by ploughing, &c. as the general crop ripens too late here for the purpose.

Although I may be allowed a natural leaning to the husbandry of Devon and Cornwall; yet I am very ready to admit, as are many of my neighbours, that these counties are capable of great improvement in the already inclosed lands. Our sea-sand, proved to be an excellent manure by long experience, and recorded long before the Act of Parliament, 7th James I. freed it from demands of lords of manors, &c. is not yet used so freely, as so great a blessing from Providence, and so well adapted to open and warm our stiff cold clay, ought to be. The small quantity used is also too often unmixed with earth, which would render it more effectual, and both thereby become a more lasting benefit, than any other manure which can be procured at a distance from large towns. Opportunities have fallen to my lot of observing, on the different effects of sea-sand and lime, on similar soils, and sometimes, even in the same fields, such farmers as use the one (though somewhat partial to their general usage) cannot fairly decide against the other. Residing, as I do, nearly betwixt both, I observe that even good husbandmen are given to change, occasionally preferring one manure to the other, so far as respects crops of corn; but it is generally agreed, that the sweetest pasture follows sand, where equally good management in the previous tillage, proportionate quantities of each manure to the acre, and each mixed, as usual, with earth have been used; and sheep have been observed to prefer, in the same field, the pasture which has followed sand manure, to that after lime. From the observations I have made on each manure, I am inclined to think, that for a crop of turnips, lime has some advantage over sand, though I am at a loss to guess at the cause; perhaps by pulverizing the earth better, and more quickly, or in some degree by keeping off the *fly*, which sand would, more probably, attract. In the last warm and dry summer, the crop of turnips has

universally failed on our driest and best soils, and have succeeded only in the moory soils, where again, in the preceding summer, few were produced, and these few small, with the leaves turned blue by the wet and cold; on such soils it may be best to till these in ridges like wheat, but wider, in order to drain off the superabundant moisture.

The inclosed lands of these counties, rendered fertile in corn by such processes, for the most part, as I have detailed, have certainly been returned to grass in an improved state, more durably so, in proportion to the greater quantity of sand or lime, but chiefly of earth, which has been used in the preparation for corn. This is sufficiently evident in these counties, formerly remarkable only for breeding cattle, and now by feeding, which has of late years followed as a reward of the farmer's toil, providing most of the fresh meat for our numerous navy at Plymouth, and all for our merchant vessels, miners, &c. which have swelled the number of an increased population, the richer part of which, in towns at least, consume more animal food, than formerly.

I would suggest to the consideration of those who may be concerned in new inclosures of wastes, forests, moors, and commons, that a great, and probably a lasting advantage, as well in corn as in grass, may arise from relinquishing, in some measure, one small portion of the soil to benefit the remainder, by removing, in the course of different tillages, and by installments, the earth to a certain depth from adjoining the borders or fences of the fields, at three or four times the distance, or more, which even a greedy rack-renter at present ventures upon, and therewith thickening and improving all the rest of the inclosure. Taking, finally, the proportion of one acre out of ten, at an equal distance from the fences, where earth in like quantity cannot otherwise be procured near, from wastes, ways, &c. would, perhaps, well answer the end, being easy of performance, and the parts thus robbed would not be ruined, but by shelter of fences from weather, and "leaving" of cattle, would become soon again productive of some herbage.

The greatest and most lasting improvements, whether on coarse moory ground mixed with spar, or stone, or clay, or in the best of old inclosures, when injured by previous bad husbandry, or exhausted by long continued tillage, which I have remarked, have arisen from large mixtures of earth with sea-sand or lime, and, what improves both) the dung of animals and wood ashes,* where either, or both, are to be procured;

* The good effects of wood-ashes are soon lost when used unmixed with earth.

still, I repeat, this does not occur often enough, by sufficient quantities of either, particularly of earth.

Respecting "under-draining of land previous to tillage," undoubtedly wherever there are springs, this is useful to all kinds of husbandry, to burning peculiarly so. It seems hardly necessary to observe, that no springs can arise through our stiff, yellow, clay, which holds but too much water, in winter, on its surface; with a view to discharge which, the land is let out after tillage in "clefts" from eighteen to twenty-four feet wide, raised by the plough to a gentle height in the centre, with intervals resembling a wide furrow betwixt the clefts. This, however, hardly answers the end of draining so well as could be wished; and it is evident that under-draining, where the *substratum* is clay, retaining water in the footsteps of every heavy animal, cannot avail; and equally so, that the tread of such animals, before the grass is grown and matted together, must be very detrimental on such soils after tillage.

As to the "depth of ploughing," it will be observed from what I have before stated, that we necessarily use shallow ploughing in the soils described, and though I have been long conversant with experienced farmers in different parts of England, where the soil was good to the depth of a foot or more, yet I never observed that deep ploughing was practised by skilful ploughmen, or ever heard that it was approved. There may, possibly, be occasions for it, but these, I think, can be but few; and none for corn to follow immediately after; it would completely render unproductive, for many years, far the greater part of the two western counties; clay, indeed, as it holds together, might be in part, and in time recovered, by turning it down again; but "the dunns" (soft shelvy rock) never.

"Whether the crops intended for cattle and sheep are to be fed on the land, and "by which kind of stock, or to be carted off," and "to state, &c." I humbly conceive that these queries will meet more satisfactory answers from other parts of the kingdom, than from Devon or Cornwall. The same with respect to "breaking up "of old pasture," very little, in proportion to the size of these counties, being ever reserved from tillage therein.

I am not able to infer from the queries, whether or not, the Board would wish to receive opinions concerning the inclosures of our wild common moors, the probable objections or hindrances, which may arise, if left to decision of persons now possessed thereof for lives or years, the best modes of fencing, &c. &c.; on which

subjects, though I may have acquired some knowledge and information, I forbear to trouble the Board, fearing that I may already have trespassed too far. Nothing therefore remains for me, but to add, that the knowledge of facts and opportunities for making the observations before stated, have arisen in part from the author's occupation of a small farm, of betwixt two and three hundred acres, for near thirty years past.

If some of the practices, &c. described in husbandry, peculiar to the west of England, (and not generally known perhaps to half the kingdom,) should excite imitation, experiment, or even inquiry, I hope and trust the result may, in some degree, prove beneficial to the public.

No. XIX.

An Essay on Gypsum as a Manure. By Mr. H. Smith, at Highbstead near Sittingbourne, Kent.

I MAY observe, that though the subject of the following Communication does not directly apply to one part of the objects proposed by the Honourable Board, "the converting grass land into tillage," yet that it does apply, with respect to the more important one, "that of returning the same to grass in an improving state." I have the best grounds to believe, that in all dry loams, sands, and calcareous soils, or on stiff churlish ones, previously ameliorated by chalk, that no manure whatever will so cheaply, readily, and permanently invigorate the exhausted soil laid down with the artificial grasses, as gypsum. In this view, though in some measure resting on theory, yet it is surely entitled to attention; be this as it may, I have still, I trust, a fair claim to the thanks of my country at large, as well as my brother farmers, for introducing and establishing a manure that promises such signal and permanent advantages to the agriculture of this country at large.

1792.

One of the first trials I made with gypsum, in the year 1792, was upon twenty perches of clover at the extremity of a long slip intended for my team. I had at that time a very favourite old mare that would sometimes trespass in quest of dainties; it accordingly happened that she met with this forbidden spot, luscious, and just coming into bloom, and liking the relish, laid about her so unmercifully in one night, that I relinquished every view of further experiment, and gave it up to her; on watching her motions, I was afterwards several times amused, with observing how deliberately she would walk the whole length of the field without tasting the ungypsumed part, which was a tolerably good crop.

The fructifying effects of this manure are evident by the seed products in my experiments on sainfoin and Dutch clover in the detail sent to the Board in 1795, and have since been confirmed by several instances on my own farm; but what particular influence affords this nourishing *pabulum* is a mystery, that the chemical philosopher hath hitherto in vain, I believe, endeavoured to solve. That a large

portion of *something* is gradually absorbed by the plant, when fed with gypsum, is very evident, by the increasing vigour, verdure, and doubtless richness of its juices, which this instance proves.

1794.

The effect, in one respect, is very perceptible, by the elasticity that is felt on walking over the gypsumed part, compared with that not gypsumed, which I have frequently remarked to gentlemen, when going across the field where the ex-gypsumed divisions were; but the most remarkable instance, and which seems to corroborate the fact, is the astonishing number of moles that resort to my gypsumed pieces of lucern and sainfoin; whether they come for sport, or for food, I know not, but the following fact must surely prove gypsum to be the cause. In the year 1794, I left twenty perches in a corner of the sainfoin without gypsum, and it continued so three years, during all which time I never observed a single mole cast within the corner, though they seemed to have been mighty busy on the gypsumed side up to the line of partition; but the succeeding winter, after it had been dressed with gypsum, along with the rest of the field, they found their way into it, and traversed it in every direction. I have mentioned this seemingly trivial circumstance, in hopes it may lead to a satisfactory investigation of the peculiar properties of this wonderful substance.

1795.

In respect to the permanency of gypsum as a manure—I must refer to the sainfoin experiment, in my detail sent in 1795, and observe, that the gypsum product did not materially decline until the fourth crop, whilst the divisions without gypsum, and that sown with soot, had become so weak, as to be scarcely worth mowing, I therefore, in the spring of 1799, sowed five bushels per acre over the whole piece; the consequence has been, that in the two last crops, the parts originally sown without gypsum could not be distinguished, the whole being a fair even crop (for such a thin soil) of about one and a half load per acre. With respect to lucern, I think the effects upon it is greater and more durable. I began with this most valuable plant at the time my acquaintance with gypsum commenced, and have gradually extended the cultivation to twenty-five acres; my first piece of four acres was manured with gypsum in 1792, with great effect, but the natural grass appearing to gain ground in 1797, the following year I gave it another dressing of five bushels per acre, which forced such a smothering crop, that the grass could not make

X x 2

a-head till after the third cutting, when it afforded, with the last shoot of lucern, such a fine rowen, that I do not consider it as very hurtful to the lucern.

I have been assured, on respectable authority, that the effect of gypsum on wheat is very considerable. With respect to peas after sainfoin, gypsumed, I cannot forbear mentioning the following fact, as told me by a most respectable farmer in this neighbourhood. It happened that my friend, after dressing a piece of clover with gypsum, had about half a bushel left, which he ordered his man to sow on the adjoining sainfoin, belonging to a perverse, obstinate, old farmer; the effect proved astonishing, and upon the old man's finding out the circumstance, instead of profiting by it, grew peevish, and wondered what business Mr. L—— had to sow his new fangled stuff on his sainfoin, which, for aught he knew, might afterwards do as much harm, as it now seemed to do good. The laugh, however, going very much against him amongst his neighbours, he determined to get rid of the cause, by breaking up the sainfoin and sowing peas; but, behold! they likewise rose up in judgment against him so powerfully, on the gypsumed spot, that he was at last, though reluctantly, forced to confess, that it was good stuff; with such conviction, can it be credited, that this perverse mortal has not tried a single bushel to this day? I may add, that my friend viewed the sainfoin and pea crops, each year before they were cut, and thought them the strongest instances he had seen of the effects of gypsum. I am therefore happy in having the opportunity of appealing, if necessary, to his testimony, as he is deservedly esteemed one of the most intelligent and best farmers in this country.

1800.

Having a field of eighteen acres upon which clover had taken well (being sown upon wheat in the preceding spring), the soil a loose hazle mould on a *substratum* of chalk, and though tolerably clean, yet much exhausted and wanting rest; on the 17th of April, I sowed five acres of the shallowest soil with exacid gypsum, at the rate of five bushels per acre, being all I had by me, and being disappointed in getting more from London, I was obliged to wait until the 17th of May, before the remaining part was sown with pure gypsum at the same rate per acre, reserving at the same time about half an acre, in three different patches, without gypsum. I perceived that the exacid gypsum, in a week after it was sown, had begun to work, and by the 17th of May the plant had acquired so much colour, and such a broad leaf, as almost to insure a lodged crop, even without rain. I now lamented that I

had been prevented from sowing the whole field at the same time; however, although the exacid gypsum had got so much start, yet by waiting a week longer before it was cut, there appeared but a trifling difference in the product. I must here mention a circumstance worthy notice, which is, that some time before the last sown part came into bloom, I observed a spot, about the quantity of a perch, exceedingly rank and lodged, occasioned, as I recollected, by several sacks being carried together there and shook, when the gypsum was sown; this double dose, amounting probably to ten or twelve bushels per acre, plainly shews that five or six bushels are amply sufficient on very weak and exhausted soils. On the 23d of June, I began to mow the clover for hay, and having uncommonly hot weather, by giving the clover good time in the making, it only took a moderate sweat in the stack, and cuts out in the highest state of perfection. There being a bridle-way through the field, I had purposely left about twenty perches, close by the road, without gypsum, which from its comparatively weak and sickly appearance, did not fail to attract the notice of every one passing by, and occasioned several persons to call on me, requesting to be shewn this extraordinary instance, which they had heard so much remarked. Being now anxious to ascertain the precise value in the hay crop, I correctly measured two square perches, within a foot of the line that separated the part sown with gypsum from the other, weighing the contents of each, and having paid equal attention to the two contrasted perches when cut for seed, have the satisfaction to believe that the several results as expressed in the experiment, are correct.

Experiment on Red Clover in 1800.

Clover hay product.

	Per Perch.	Per Acre.	Value at 6s. per cwt.		
	lbs. oz.	cwt. qrs. lbs.	£.	s.	d.
A. Gypsum - -	42 0	60 0 0	18	0	0
b. None - -	14 0	20 0 0	6	0	0

Clover seed product.

	Clover straw per Perch.	Clover straw per Acre.	Amount at 12d. per cwt.	Seed per Perch.	Product per Acre.	Value at 12d. per lb.
A. Gypsum	lbs. oz.	cwt. qrs. lbs.	£. s. d.	lbs. oz.	cwt. qrs. lbs.	£. s. d.
b. None	16 0	22 3 12	1 2 9	0 10 1/2	0 3 21	5 5 0
	3 8	5 0 0	0 5 0	0 2	0 0 20	1 0 0

	£. s. d.
Amount of hay product with gypsum - - -	18 0 0
Ditto without gypsum -	6 0 0
Extra value by gypsum	12 0 0
Deduct expence of gypsum	1 0 0
Clear gain by gypsum -	11 0 0
Amount of gypsum, seed value	5 5 0
Ditto, without gypsum -	1 0 0
Clear gain by gypsum	4 5 0
Amount of gypsum, straw value	1 2 9
Ditto, without gypsum -	0 5 0
Clear gain by gypsum	0 17 9

	£. s. d.
Total clear gain by gypsum, viz.	
By hay crop - - -	11 0 0
By seed - - -	4 5 0
By straw - - -	0 17 9
Total gain	16 2 9

Here is £16. 2s. 9d. absolute clear gain from five bushels of gypsum. I shall here also mention, that, exclusive of this clover, I had also ten acres of lucern, five acres of sainfoin, and three acres of Dutch clover, dressed with five bushels per acre, which, to all appearance, received equal benefit.

I have had, for four years past, a considerable quantity of exacid gypsum from a Mr. Hufton in White-chapel Road, who annually imports five hundred tons of the pure gypsum, from which he extracts the acid, or oil of vitriol; the *residuum*, or calcareous earth, mixed with bone-ashes, and the rubbish from various other substances made use of in his business, he usually sells to the Essex farmers to manure grass land. In my first conversation with him on the business, he seemed averse from mentioning any particulars about the process, only saying he got *something* out of it; but on my expressing a desire to try some of it, he agreed to send me eight sacks for a trial, with two hundred bushels of the pure sort; accordingly I sowed equal portions of lucern and sainfoin, in alternate stripes, or divisions, with

equal quantities per acre of the two sorts. The first and second year I could not perceive any difference in their effects, but afterwards plainly perceived the exacid decline; but as three bushels of the pure, weigh as much as four of the exacid, perhaps equal *weights* per acre of the gypsums would produce the same effects as to *duration*. Taking this for granted, it is still very extraordinary, that though reduced to an almost pure calcareous earth, it should nevertheless have as much effect upon a very chalky soil, as upon a deep loam. The little I can pretend to say about the matter, is, that looking in Bishop Watson's Chemical Essays, Vol. II. p. 110, I find that the vitriolic acid is obtained from gypsum by boiling it with pot-ashes; now, if a considerable quantity of the latter is made use of in Mr. Hutton's process, may we not suppose that some portion of the alkaline salt is imparted to the calcareous earth?

General Observation.

By referring to the experiments on clover in 1800, and taking the several net gypsum products added together, it will place the subject in a new and interesting light; thus I find the hay crop - 40 cwt.

Straw nearly - 18

Reckoned for rowen 2

Net weight per acre from gypsum 60

Weight of gypsum sown per acre 5 cwt.

whence it appears, by an easy calculation, that gypsum gives twelve times its own weight of dried nutritive food from clover the very first year, exclusive of a probably considerable effect on the succeeding wheat crop; but in sainfoin and lucern, I am satisfied that this proportion will be the average of three successive crops at least, having generally found the second crop heavier than the immediate gypsumed one. Without therefore taking into the account the final aggregate value, where is it possible to find a manure that will do any thing like this! the prime cost, with every expence till it gets to work on the land, is in many instances not equal to the carriage of bulky heavy manures, when carried to any considerable distance; and as I understand, that if the use of gypsum was to become general, there is an inexhaustible supply, perhaps for ages to come, to be met with in various parts of this kingdom, I cannot help indulging the idea (from the data of my own experiment), that if from one to five or ten thousand tons of this article, which bounteous Heaven has given

us, were annually strewed over the dry loams, sands, and calcareous soils under seeds, what would be the consequence, but a most superabundant supply of hay and green vegetable food (the rough material of beef and mutton), which aided by a concomitant effect on grain, must prove the most prompt and sure means of restoring and ensuring plenty. Hence I see in this precious stone, a surer rock of defence against future dearth, than in thousands of acres newly inclosed on barren heaths, or dreary unprofitable wastes and commons: the object of reclaiming such soils and making them productive, is doubtless truly desirable, and may best be effected by gradual means; but if attempted on the spur of the moment, a proportionate degree of the active force and intelligence, now employed on improving the poorer soils at present under cultivation, must be withdrawn. Here I must stop,—and commit the important subject to abler heads than mine, with only observing, that the maxim of “ ’tis not in how *much*, but how *well* you do it, that the advantage lies,” must surely apply as strongly in the wide scope of a national concern, as in the narrow limits of a farm.

An enterprising farmer at Sittingbourne, who has the advantage of a water-mill, is now importing a large quantity of gypsum in the rough stone, which he means to crush for the supply of this neighbourhood, in consequence of the difficulty that has been met with in getting it from London, and the loss of sacks, &c. The quantity brought down by the Milton and Sittingbourne hoys, and to Faversham last year, amounting to three thousand bushels, must evidently prove the real estimation it is held in. I can now only add, that whatever testimony the Honourable Board may deem adequate to the merit of my ardent endeavours, it will be received with the most grateful respect, and warm my bosom with the pleasing reflection of having contributed something towards the improvement of Agriculture, and the consequent increasing prosperity of my country.

No. XX.

"The best Means of converting certain Portions of Grass Lands into Tillage without exhausting the Soil, and of returning the same to Grass, after a certain Period, in an improved State, or at least without Injury." By James Roper Head, Esq. at the Hermitage near Rochester.

PREFACE.

FOR twenty years and upwards I have been a practical farmer; nearly one-half of this term was past in cultivating poor arable wet clays, and wet grass lands; the remainder of the term on dry gravels, light loams, and chalky soils, wholly arable. Like Æsop's cock, I have scratched the dunghill, whether I have found the jewel will be seen hereafter. The "*viginti annorum lucubrations*," carries with itself, however, no claim to indulgence; it stamps no authority; the question is, not whether a man has seen much, but how well he has seen. Experience is not always the parent of wisdom; men live harnessed and strapped sometimes to favourite theories, they pass through life with their eyes half open, and in those cases experience confirms the evil it cannot cure. Before I sat down to write this Essay, I studied for a week, to endeavour to understand, not only the literal injunctions of the Board, but to endeavour to seize its general object and intention. I determined to apply to no book or books for information: this did not proceed from any irreverence for science, but I thought, I saw something like a wish in the Board, to know what the earth has told a man in the last twenty seasons of its annual vegetation and cultivation, upon those small and limited points of it, upon which I have, for that time, stood and watched it. I am far from the presumption of casting away all theories, but too old and cautious to adopt them, by whatever names they are supported, unless I have seen their effects myself.

IT appears to me most clearly, although the words above written do not express it by their letter, that from their general meaning and intent, all those rich and valuable pasturages and mowing lands which ornament and support the country, are quite

excluded from this investigation; inasmuch, as that no interest can require the breaking up those valuable depots of the fructifications of centuries, nor could any art produce an herbage equal to that which Nature, matured and ripened Nature, has blessed us with.

The grass lands alluded to by the Board are therefore, in all probability, meant to be confined to those places where the present herbage is weak and unproductive, and where the action of the plough may be called upon to destroy the present penurious product of the soil, upon the rational expectation of reproducing grass either better in quantity or quality, or in both, than it ever did before in its state of nature.

The general mass of this sort of land (admitting in the fullest degree of many strong and contradictory exceptions) lies, for the most part, far from the reach of towns, to purchase manure; it must be, therefore, created upon the spot itself, but this can only be done by judicious cropping.

The plough, in all soils and positions at all favourable to its action, may be relied upon for totally extirpating the present produce of these lands, but it depends upon general causes and effects, whether of itself it can arouse, by the scope of its agency alone, the stagnated fertility of poor soils. I look upon the plough as the means of melioration; but this melioration must always be highly assisted, and at times absolutely produced by the factitious manure of cropping, and of cropping only.

A jack-ass can carry on his back the first cause of probable improvement, sufficient to extend over one hundred and fifty acres of land, by loading him with one and fifty pounds weight of turnip or cabbage seed, and using it properly and with success thereon.

I should conceive that an acre of turnips or cabbages once procured, and properly fed off with sheep, must leave the soil on which they grew sufficiently strong to lay it down with grass.

If land is so barren, that all effects of fallowing will not give it strength to produce something; if after laborious and skilful ploughings and preparations it will not grow a green plant; if its soil burnt into ashes has no visible effect on its vegetation; if it produce no lime, marl, or other prolific manure, on, or rather under itself, it is a lost case, and ineapable of relief by human industry.

In as much, therefore, as, in my opinion, the wisdom of the Board has excluded all those rich and fertile grass lands, it has in the same manner meant to exclude all such soils, as from position are so extremely poor, as to hold out no rational attempt

of improvement, their meaning, is to attempt the spirit of rational and well directed labour; they seek no new theories, they demand practice; they have not to learn from me, that man may frequently assist, when as man he can not alter Nature. They do not expect a rich water meadow to be created on a Scotch mountain; and when Nature has indented, with a deep and heavy hand, the surface of the earth into hollow and low cavities, every where surrounded by lands of higher level, they are willing to leave that as a lake and bog, where Nature has cried aloud they shall so for ever remain.

The Board would reprimand, rather than encourage, the frantic attacks of that wild speculator who should attempt to drain them. I hope then I seize the spirit of the Board correctly, when I conceive their sole object is to learn, what mode of treatment is the best for the conversion of such grass lands, as fairly invite a practical man to embark his time and property on rational speculation; and above all, to be told the best probable mode of applying general principles to particular practice.

"The Course of Crops, regard being had to the Varieties of Soil, and the Time proposed for continuing the Land under Tillage."

If I were placed on an unknown grass land, I mean on land, the properties of which could only be learnt from its outward vegetation; the first object of my inquiries would be the state and nature of that vegetation. If it bore nothing but whins, or ferns, or weeds, still I would diligently study even their nature; because vegetation is the hand-writing of the earth itself; and in strong soils it is bold and legible, in poorer soils it is naturally weaker, but hardly in any soils such, as suit the purpose of this inquiry: is it so faint as not to give something like a clue, to tell you what it is? A thistle will grow in a poor, but grows proudly in a richer soil; the nature, depth, and quality of the soil would speak for itself.

The second object would be to endeavour to find out, by any deep roads or ditches, and also by boring, which is a very cheap and expeditious experiment, what the nature of its subsoil was, whether it had marle under sand, or sand under clay, or lime-stone; whether, in short, it possessed any concealed powers of improvement. If from these appearances, I thought that it was in itself capable of being assisted by the means of its own territory, I should not be afraid of attempting its improvement. The course of crops is not of such primary consequence, as to know whether you can grow any, or what crop. On such land, I would employ

a double strength of teamage; if I began my career at Michaelmas, I should prepare as much as I could get fit to receive a crop of tares at Christmas; if from its nature the land could not be got ready so soon, I would continue working it, and risk a crop of turnips in June, July, and August; if the turnips failed, I would try tares the next October. In short, my system is (if such simplicity can be called systematic), by repeated green crops alone to nourish the land, and manure it until it could be laid down to grass in the best manner its nature would admit; as to the time for continuing the land under tillage, it depends entirely on the state of its soil, and the impediments found on its surface. In general in two, but at all events in three years, one hundred acres, with a double strength of teamage, might be so well tumbled about, and so well helped by alternate crops of tares and turnips, as to lay it down in a most husbandlike manner.

On the supposition that the tillage of the first year failed entirely, the remaining two years might produce, from October to June, an ameliorating crop of turnips, in both cases to be fed off by sheep.

I have seen some few instances of green tares, and clover in full bloom, ploughed down in their fullest luxuriance of growth; but I could never see any encouragement to adopt that system myself.

*"Also to explain the Cases in which it may be eligible to drain Land previous to
"Tillage."*

Lands which are regularly overflowed in the winter months, and which lie in levels incapable of drainage, can never be lands capable of general tillage; they may produce good crops of spring corn, but for all grain usually sown in the autumn, they cannot be considered as legitimate corn ground: presuming, as I have all along, that the Board have in view tillage, not as the parent and creator of corn, but as the necessary operation of improvement, it seems to follow of course, that all lands ought to be drained, if drained they can be, previous to tillage, without any one single exception.

*"In what Cases Paring and Burning are advantageous, with Directions thereon,
"regard being had to the subsequent Cropping."*

In respect to paring and burning, like other general principles, it has on one hand been too highly valued by some, and much too contemptuously treated by

others. It is a fact extremely well known, that manures of all kinds, and particularly those of a hot nature, are liable to have their effects perfectly suspended by severe drowths early in the spring.

I have frequently known myself, and have had it frequently communicated to me by others, in certain seasons dunged wheat lands have never shewn the least luxuriance of vegetation above the unmanured lands.

I have also repeatedly found soap ashes, wood ashes, and paring and burning ashes, all in these parching times, have had their efficacies perfectly locked up; but I must not on that account say, that because their virtues were suspended, they were lost.

It must also be confessed, that on many soils paring and burning is mere waste of labour; in soils partaking of a clayey nature, the action of fire does not produce ashes, it burns into hard stubborn clods, which require years to melt them, and when they gradually rot, they have only "incumbered the land they could not fertilize." With these exceptions, however, I think that most frequently they are most powerful, and the cheapest of all natural manures, excepting only those manures of turnips and tares fed off with sheep, which, for the sake of distinction, I shall call artificial.

As to the proper depth of paring and burning, it depends first upon the depth of the soil, and next upon the depth of the roots of grass and weeds growing on that soil; for paring and burning in most cases combines in itself, not only the manure, but the almost total operation of a fallow; it generally cleans as well as enriches the ground: all roots of weeds, therefore, must be well bottomed up and consumed.

In deep clay soils, some of which, however, it must be remembered, are very ticklish experiments for paring and buring, the roots of weeds and grass run shallower, than in light soils; but three inches depth of soil, if it be well coated with turf, will produce a good cart load of ashes on every square perch, and is fully sufficient, with one ploughing, to produce a reasonable expectation of a crop of turnips, to which crop I believe it to be generally the most certain and powerful parent.

In general, it is a matter of difficulty to get it done on a very large scale; much depends on the weather; frequent heavy rains suspend the operation, and in some wet seasons make it impracticable, and the favourite and best times for doing it, are the warmest and most busy months of the year.

In regard to the proper crops which ought to succeed it, I am more decided on this opinion than almost on any other; it is, in my opinion, the most forcing operation for a single crop of corn, it is highly active for a season, and will run a

crop excessively strong, but then the half of the value of the fee of the land the crop grows on, is eaten up.

There can scarcely be a more complete *caput mortuum*, than poor land pared and burnt, and then exhausted by corn crops; but as the commencement of a fresh grass system on worn out grass, or on natural poor grass, with a constant reference alone of assisting the land and helping it to manure, by the consumption of grass or green plants on its own bosom, it beats every thing.

In short, if you use paring and burning, as a nurse to help a weak child, the weak child may grow to a strong lusty man; but if you make it an experiment to try what you can lay on, and take off the land, in the smallest possible time, you may carry a great deal off, and leave the land an infant in power almost for ever.

"The Depth to which Grass Lands should be ploughed at first breaking up, and whether the Crops are to be fed on the Land, and by which Kind of Stock, or carted off?"

The question of deep and shallow ploughing has been as old a dispute amongst farmers, as the hills and vales themselves on which it has been tried.

Wherever the tillage of a country is generally heavy, the same strength of teamage is employed, as on the most light; and, on the contrary, where the general tillage is light, the same strength is used as on the most heavy lands: these are facts which prove nothing but the existence of prejudice, but not of reason.

When the question is asked, which is to be preferred for lands intended to be continued in tillage? I know of no other answer to be given, than to consult what the experience of past practice, on lands nearly of the same nature, has been.

A Norfolk farmer would smile at deep ploughing; a Kentish farmer would smile at shallow ploughing; and yet both these men, varying in their opinions of the same fact, would each grow very good crops of corn.

But in the case under the immediate consideration of the Board, which has only in view the amelioration of grass lands by judicious tillage, it seems reasonable to prefer light to heavy ploughing, because all things else being equal, it must be preferable to have a small depth of soil to cultivate and improve, rather than a deep one, and in as much as the fibres of grasses in general (sainfoin, clover, and lucerns apparently excepted) are fed from the upper surface of the earth alone, if they find in that surface sufficient *palulum*; all that lie underneath their nourishment, and

has been, with much labour moved by the plough, is like a stock in trade which requires an extra-capital unproductive of interest.

I have said that sainfoins, clovers, and lucerns are apparently exceptions to the general rule.

I have endeavoured by all and every means to search into the nature of these grasses, and the result of my opinion has been, that the long penetrating tap roots of these grasses pierce the earth in search of moisture only; that the tap root is the mere syphon and duct; that the branches of the crown of the plant are fed alone by the upper surface of the soil; and that the luxuriance of their produce depends not upon any congeniality of the bed or *nidus* of the tap root itself; but in the congeniality of the soil of the upper surface, which alone feeds and furnishes its vegetation.

I own this is theory; this is opinion, which if it be contradicted, I have only to request a solution of the following questions.

Can any practical man believe, that in light soils particularly, where the subsoil is chalk, gravel, or cold chilling clay, plants can derive nourishment from the subsoil composed of such materials? If he does, let him try this experiment; let him bury at a foot deep or more some good mould well dunged; let him place the subsoil of chalk, gravel, or cold chilling clay at top; let him upon such a surface sow seeds of sainfoin, clover, or lucern: when the seed is thus deposited, mark only its progressive action.

It is deposited nearly on the surface; the progress of its vegetation is this; it must first look downwards before it looks upwards; if the surface on which it lies be at all alimentary, its roots descend below for one whole year before it rears its head equally high above; where then is the central point from which these plants diverge their vegetative rays? It can arise from no other spot than the *nidus* of the seed itself; if that *nidus* be unpropitious to its progression, its roots must hunt after the buried treasure, which ought to be its original nutriment.

In answer to the question "whether the crops are to be fed on the land, and by what kind of stock," it is ever constantly to be remarked, that I bear in mind, not a general answer to the question itself, but to the peculiar interest which the Board has most wisely in view, of bettering grass land by the operation of tillage, the plough being perfectly subservient to the improvement of the grass land itself, and to be used only as the means of doing that, by the most cheap and rapid exertion of any operation yet known.

In all attempts of improvements of this nature, the crop should in the first place be suited to the nature of the land.

When I was very young in practice, I had succeeded often in growing upon wet clays very fine crops of turnips; but I robbed the land, and cheated myself. It is not a pleasant office to criminate ones-self, but where practical truths are demanded, the debasement of an individual's consequence is of no importance; and he who searches after truth, need never blush at the blunders he has committed in his attempts to find it.

I most solemnly believe, that clays of all soils are the best adapted to the growth, but not to the use of turnips. The radical error which I committed was, that when I had, as I thought, succeeded in procuring a fine crop, I thought the speculation was wind and water tight; but I could not use them either on the land on which they grew, or even off it with any reasonable profit.

As to feeding them on the land, it was in itself impossible; no man knows from theory alone, unless he adds to that most patient practice, the poor, vulgar, and apparently trivial truth.

There are soils which grow the best turnip crops, and where no art whatever can render them useful.

At Wookey in Somersetshire, it was a great exertion of a strong man's power to draw a turnip from the ground, and when drawn up, it came up with a large weight of heavy clay. No animal could eat it thus surrounded with its shaggy coat and no water, not even the stream of a strong water current, driving in its progress all the mills which feed the country, could purge the plant of its feculant soil.

These are the minutiae of practical observation, very easily to be laughed at, but which cannot be contradicted.

If a crop is to be fed on the land, there is no doubt of which animal will pay the best for its consumption.

A sheep stands in the highest pre-eminence of consumption, it does less damage by its tread, it furnishes most contributory remuneration for the exhaustion of produce; the very unction of its fleece is manure to the land, it feeds close, and comprises in itself each and every benefit that can possibly be procured.

*"The Crop with which the Grass-seeds in each Case might be sown when the Land
"shall be laid down again?"*

The true principle of laying down land is, that it should be perfectly clean, as perfectly fine as a garden, and in as good heart as previous cultivation can make it. The crops usually sown with it are oats, and sometimes barley; it will be difficult to find better.

I remember, wishing to lay down a field quickly, I sowed grass-seed on a field of tares, when the tares were four or five inches high; I supposed, that in feeding off the tares with sheep, that they might tread in the seed, and I thought I would run my chance of the seeds taking, for I could lose but their value, and if they succeeded, I should save a year by it; if they failed, I must have ploughed up the tares in October, and I could not have sown grass-seeds until the spring following; it answered very well, the grass-seeds took admirably; but it is not a mode, I think, worthy of general imitation.

In most cases when land is laid down to grass, the crop of corn sown with it, is considered more as a cover to the grass than as a crop; if the land is in strong heart, it is best to sow but one half the quantity of corn which is used for a crop.

The best oat I ever saw for laying down land is the red oat, the straw of which, although finer, is much stiffer than other oat straw, and less liable to lodge by heavy rains.

I have seen repeatedly heavy crops of Poland oats beat flat to the ground, and heavy crops of red oats enduring the same storms without damage; it is very easily accounted for.

The Poland oat grows with a very large broad leaf, provincially called, "the riband," which carries a great deal of water, and more easily forces the plant to the ground than the red oat, which has little or no riband at all.

Oats have another very decided advantage over barley, for if the grass-seeds grow luxuriantly during the summer, the grass may run high, and it will then be mown, and remain in the bottom of the sheaves.

Now a sheaf of oats burdened with grass at its bottom, is of no immediate consequence; it is true, that the oats, however dry, are not fit to be stacked or imbarnd, until the grass is withered; but all oats are the better for having a little rain fall on them, after they are cut; it helps to rot the small cuticle by which the oat sticks to the straw; it fills up the grain, and they thrash better in the barn.

They will also bear a great deal of rain without damage, and may be carted in safety in such a state of dampness, that were barley carried in the same state, it would inevitably fire.

Of all grain whatever, barley is the soonest hurt by the wet, and consequently most difficult to be harvested in good order.

Barley also is of all corn the least liable to shed its seed; those winds which whip out perhaps two sacks of the best head oats per acre, fly over a field of barley without beating off a peck. Barley also will stand without shedding, until its straw be perfectly fit for carting. The best mode of managing barley, is, after the sun has perfectly dried the dews, to cut and carry it immediately.

This, however, cannot be done, if there is a luxuriant grass crop at the bottom of the swath or sheaf: in that case, the barley, after it is cut, must abide the vicissitudes of the season, until the grass cut with it, is completely dried, and this at a very great risk or loss.

These are, however, circumstances which do not take place every year; if they did, no one would ever think of using barley as a laying down crop.

The advantages of sowing barley are, in my opinion, reduced to one single point, which is, that if land is not sufficiently fine before the end of April, it is then a better season for sowing barley than oats.

"The Sorts and Quantities of Grass-seeds for each Kind of Soil, and whether to be provided by Landlord, or Tenant?"

It makes a man tremble at his own insufficiency, when he is called upon to answer satisfactorily a question so very general, as is here brought forward for discussion.

Soils themselves, with their marked varieties, are known under the titles of clays, loams, gravels, &c. but their caprice of product, and how they effect and cherish particular grass-seeds, is one of those arcana which, I am afraid, lies hid from the most accurate theory.

The reason why I entertain these doubts, is from two facts within my own knowledge, which I have often repeated to the best practical men, who always admitted their truth, but never pretended to give any solution.

The first is this; there are certain lands, on which if you sow broad red clover and feed it off with sheep, do what you will, it will never place an ounce of fat on a sheep's bones, and yet on other lands, the same grass will fat them kindly.

In all other respects, the broad red clover seems equally adapted to both; the product in point of appearance and quantity to the eye, or to the steel-yard, if weighed, is the same, and yet the qualities are so widely different, that in the appropriation of its use to fattening sheep on one sort of land, it is excellent, and on the other is worth nothing at all.

Another fact is this; there are some lands which, if sown with either gray or white peas, will turn out, according to their known character, a boiling crop, or a non-boiling crop, whatever the seed sown on them may be.

If the land is boiling land, and non-boiling white or gray peas are sown, the product will invariably be boilers; if the land is a non-boiling land, no boiling pea that is sown, will produce a boiling crop.

If ever this Essay should see the light, if it ever falls into the hands of those numerous classes of worthy men, now engaged in the charitable offices of rendering assistance to the poor in the metropolis, by affording nourishment at a cheap rate, they, considering the pressing interests of the moment, will pardon me when I inform them, that the London market affords no sale for boiling gray peas, as boilers.

Whether gray peas boil or not, they carry the same price; the fact, however, is, that bating that prejudice which custom generates and confirms, it is a very great pity that the boiling gray pea, the very common food of the poor in other countries, should in these pinching times be almost wholly neglected, and classed in a description of inferior consumption, and deemed as useful, only for hogs and other appropriations of that nature, when at this moment a boiling gray pea is, in point of weight and price, the cheapest and most nourishing food a poor man can have.

In addition to these singularities of the product of the soil, where the seed sown does not reproduce in its crop the representation of its own nature, and where the soil riots in its own caprice, may be mentioned the well known fact, that some grass lands are exclusively good for horses, some for milch cows, some for breeding sheep, some for fattening sheep, and some for fattening oxen.

If an experienced botanist were to examine the grasses growing on them; if an experienced farmer were called upon to determine the soil upon which they grew, the botanical and agricultural description of all these fields, laying perhaps nearly adjoining each other, would vary but little, perhaps not at all, and yet their properties vary, although their original natures are the same.

If then these grasses, on lands nearly adjoining, differ so much in their effect

and use, the Board will naturally see, with what modesty a man ought to wield the didactic sceptre, on such a subject.

The best general answer I can possibly give to this question, is to consult Nature herself at her own home.

All lands that have been ploughed, shew almost every year their particular affection for weeds and grasses.

As to weeds it is singular, but true, seldom a season passes, but that some weed or another makes a predominant shew; sometimes the wild carrot, sometimes the challock or charlock, sometimes the thistle take their annual turn of predominance; but in respect to the affection which the soil has for grasses, it is invariably regular; some light soils run rapidly to nothing but couch, others quickly and strongly shew their partiality to natural trefoils and white Dutch clovers, some run to stalky bents.

Here Nature must be closely watched, whatever the produce of the hedge, the lane, the ploughed land in autumn presents of its own nature to the eye of the observer is, in my opinion, the only answer to the question here discussing.

Much also may be learnt from the character of the surrounding country, whether it will fat, or only rear cattle; whether it is sheep, or horse, or cow land; much may also be learnt from the tradition of the neighbouring peasant; if you ask him for facts, he is a faithful register of the history of his neighbourhood; if you ask him for opinions, you must be content to rely on his prejudices.

He who in his closet can say with what grass-seeds lands in general ought to be laid down, may paint upon a wall a human face, and call it the exact resemblance of all created men.

Such are the endless varieties of the dispositions of nature in its produce. The difference of effect between sowing a greater or less proportion of seeds can never produce any other natural consequence, than, that upon the same given space many more or many less plants can be produced; I will attempt to illustrate this by a practical fact.

In my neighbourhood, the practice of many of the best farmers, was to sow nearly twenty pounds weight of clover seed per acre; I never sowed above ten.

I do not know that their practice is right, and I do not know that mine is wrong; the earth can do no more than bear her burden. Where plants stand very close together, each struggles against his neighbour, and what they gain by thus crowding together, they lose in height. If the landlord furnishes seed, I would recommend

twenty pounds per acre; if the tenant is to purchase them, I dare believe he will be satisfied with ten.

"Whether it be best to mow or feed Grass in the first Year after laying down? to detail the Management in each Case, the Manuring which may be thought necessary in each Case, the Principle on which an Increase of Rent ought to be estimated, to break up old Pasture now under Lease."

The advantages of mowing grass, to carry upon other lands to feed are always doubtful; at first sight, it appears a practice of rational economy to carry off the food, which is to support the animal, from the place where it grows to another place, where all that is brought to him is consumed without waste, because we all know that every animal eats only with one mouth, but that he has four feet, which sometimes destroy more in wet weather, than the mouth consumes, and that no plant rallies so quick after the bite of an animal, as it does after the scythe.

But, on the contrary, if grass is mown early in the year to be carried into yards or in cribs off the spot on which it grows, and that hot weather comes on, it most considerably injures the aftermath, so that, as a general practice it cannot be recommended; however, there may be partial circumstances and positions which may justify the practice in individual cases.

But perhaps the meaning of the Board is not yet seized; they may wish to know whether it is best to mow the grass for the purpose of making hay, or to feed the grass on the first year after laying down. I may, without any affectation, assert, that during the whole of my agricultural life, I have above all things watched this question; to be sure all theoretical knowledge, all that reasoning can suggest, must make it appear highly probable, that feeding the produce of the land on the land, must be a great strengthener to it, and I should, such is the bias of my mind, indisputably prefer feeding it on the land, before mowing it for hay. But I must say, I never have, in all my practice, perceived the least advantage either on my own lands, or on those of other people, which will warrant my saying, from practice, that lands fed, derive greater benefit from their being so managed, than they would have received from being mowed. It is one of those doubts, which I am obliged candidly to confess. Supposing, however, that feeding is the best, I believe the general principle of its detail to be this; never to turn in stock, till the plant to be consumed is

arrived at its fullest growth, and so to stock it, as to consume it quite bare into the earth, before it begins to decline.

This principle of letting grass grow to its rank perfection, is, I own, directly in the teeth of all systems of good grazing; but then it is to be recollected, that at this moment I am recommending a mode of consumption, not at all calculating upon the benefit which the stock fed on it, is to receive, but to give to the land the fullest possible benefit, it can receive from the consumption of the produce on the land itself.

My idea is, that, speaking of common grass, as soon as the fine bents begin to bloom, it will be ready perhaps in a fortnight to mow; I would, therefore, when the bents begin to bloom, stock it so very heavy with cattle first, and afterwards with sheep, that the whole, if I may be allowed the expression, would be mowed clean off, by the teeth of the stock, by the time it otherwise would have been ripe for the scythe.

A very reasonable objection may be made to this system, which is, that if a fortnight's rain was to come, or even if the rains were heavy, that upon deep grass much would be wasted; but who can legislate for, or against the weather. In the time of year when the bents begin to bloom, the days are at the longest, and a few hours dry weather would retrieve what, in cold months, would inevitably rot.

I think the principle good, as a general one, for doing the best for the land itself, but extremely liable to contingencies of the nature above described.

As to what manure may be necessary in each case, whether the land is mowed or fed, it is impossible to say any farther, than that in both cases, the quantity of manure ought to be as much as the cultivator can get, worth the money.

It appears to me, to be impossible to give an answer to the question of "the principle on which an increase of rent ought to be estimated, where permission may be given to break up old pasturage now under lease."

The reason of the difficulty is, that the words now under lease, do not convey any accurate idea of what the tenant's interest is; if the inquiry had stated the tenant's term to be seven, or any other number of years, a calculation might have been bottomed upon a valuation of the value of the fee, and of the tenant's proportion of occupancy.

All I can say is, that if I had an acre of old pasture land, let to a tenant at forty shillings net, I should think, if he broke it up for corn, he reduced the value of my

acre to one half of its original worth, and I would by no means suffer him to break it up for less than a farther rent, equal to four per cent. on the half of the value of the land.

I reverence the old pasture of England, and pinched as we are, at the present moment, by a temporary dearth of corn, I hope I shall never see our old lands broken up by the plough, until such lands, as are dying away for want of its assistance, have been first brought into tillage, and laid down in their room; till that period arrives, it will be difficult, I hope I may say impossible, for any landlord or tenant so to found a reciprocal interest, as to meet upon the question.

"Clay in all its Distinctions and Soils too wet for Turnips; Loam in all its Distinctions fit for Turnips; Sand, including Warrens and Heaths, as well as rich Sands, Chalk Land, and Downs, Peat, including moory, sedgy, rough Bottoms and Fens."

The different variations of soils of clays, loams, sands, and peat, as connected with the interests of the present inquiry, ought to be, as I conceive, commented on, perfectly and solely, as respecting the views and wishes of that particular inquiry, which the Board are desirous of making, that is to say, the improvement of grass grounds by tillage.

Confined to this point, I shall point out what course I should pursue practically on these varieties, making the supposition, and a very fair one it is, that I was called upon to apply the principles of practice to each.

Whatever the soil is, whether clay, loam, sand, chalk, or peat, if it be land, to be laid down, the previous process of its cultivation though varying in its mode, yet must all be reduced to one and the same point; it must be all made perfectly clean, and perfectly fine.

Clays in all their distinctions differ much more in produce than they do in soil, the only general rule concerning laying them down is, the same general rule, which will invariably hold good for ever, and every where, and it is this:

That no man can describe, no pen can write the multifarious singularities of creative and sportive nature; the only probable clue, which can unravel the mysteries, lies not in volumes or in theories, but on the very bosom of the earth itself. The herbage of the surrounding fields is the polar lesson of instruction, of what the earth naturally likes and retains.

I assert, with confidence, that no man living can tell me, what seeds a pasture ground, two hundred years older in its lay than himself, was originally sown with.

I believe, generally speaking, that clays comprehend the largest and best proportion of grass, of any soil in this kingdom, and in laying them down I should prefer, as in most other cases, the original stock of grass-seeds of the vicinage; I would buy and thrash the hay of the neighbourhood for the sake of the seeds. The loss of seed taken from the hay would be but a small diminution of its value, and it doing this, I should be sure to sow seeds, which Nature had approved of, and sanctified.

As to loams, sands, and chalks, as connected with the intentions of the Board, of improving grass lands by preparatory tillage, I conceive them to be all nearly kindred children; loams indeed are non-descripts, for being a centre point, it is impossible accurately to say where a clay sinks into a loam, or where a loam becomes a sand, and being an hermaphrodite with a very unfixed genealogy, its definition is difficult to be made with any accuracy.

It is the common nature of sands and chalks, to run very much to couch grass; their bottom is so hot, that in warm weather the action of the sun on the surface, and the perfect want of moisture at the bottom, places every plant that grows, between two fires; the seed peculiarly adapted for this soil is sainfoin; it is the nature of sainfoin to pierce through every entanglement of the fibrous roots of couch.

In general, in an old sainfoin lay, on a chalk soil when the sainfoin has been cut, and its after product eaten off, you will, at Christmas, see nothing but a bed of thriving couch, and in the succeeding year, you will see nothing else but a bed of sainfoin.

Downs, for the appropriation of sheep-walks, are extremely great conveniences to the parent farm to which they are annexed; they can seldom be broke up to advantage when they are so used. It is almost an incredible fact, how stock is supported, in pinching times of heat, in summer; an ox, on good land in these seasons lives and grows fat, on what would scarcely, in point of weight, support a rabbit.

There are certain vicissitudes of heat, when animals require very little nourishment; there are also certain vicissitudes of cold, which seem, from their effects, to lock up the appetite, as it were, and to subjugate the nature of the animal to the casualties of the seasons.

An ox will thrive almost on sunshine and water, in hot weather: a poor Mendip wether sheep will support himself alive, for a fortnight, completely covered and

buried under snow in the winter, provided the snow is drifted against a stone wall, the common defence of the Mendip hills; and that he stands upright while the snow is falling; if he lies down at first, he never rises; but if he stands, so as to have a sufficient space to lie down when he is tired, he lives in little want of food for ten days, or a fortnight. This is a fact well known to the Mendip farmers.

"Peat, including moory, sedgy, rough Bottoms and Fens."

Of this description of land, I know nothing from my own experience; I have, however, seen a great deal of it, I have lived with it under my eye, practically I am, however, not able to say a syllable, but I have thought much upon the subject; I have thought that these, above all other lands, are capable of the cheapest and most productive improvements.

The general principle of this, is not to attempt to alter their nature, but to endeavour to assist it.

Soils of this kind have nothing to do with corn and pasturage;* but there are plenty of aquatic plants, such as willows, alders, &c. and water shrubs, if I may be allowed the term, also reeds and long rushes, which would grow there, if once planted.

The best known thatching is that, which, in ancient times, was made of rushes; I have seen a few instances, where rushes have been thatched over and over again with straw, and have remained sound. The next best thatching, is with that long reed, which grows on the banks of the Thames, from below the Isle of Dogs to Gravesend. This reed is very common in marsh ditches, and in all sorts of meeres, but straggling in patches.

This thatch has full three times the duration of wheat straw, and would be cheap to be bought at the full value of wheat straw, even if a land carriage of thirty miles was added to the expence; it packs very close, is very long, and the coat required for a roof need not be above one half so thick, as where wheat straw is used.

A waggon load, therefore, goes as far again as a waggon load of wheat straw. It is a perennial plant, thickly matted with fibres at bottom, easily planted, and spreading itself freely in every direction. In lands where this grows naturally, it is an encouragement to cultivate it, for cultivation is not the creator, but the assistant of nature.

The same general rule applies to this, as well as all the preceding cases, that the natural vegetation of the earth is the best instructor.

* This observation, so far as pasturage is concerned, must be received with caution.

No. XXI.

*An Essay on the best Means of converting Grass Lands into Tillage, &c. &c.
By the Rev. A. Youle, West Retford, Notts.*

MY LORD,

THE questions which have lately been proposed in the public papers for general investigation, and to the discussion of which, the Board of Agriculture has invited the knowledge and experience of all, who have made them their particular study or occupation, strongly evince the zeal with which they are prosecuting the grand national object, for which they are incorporated. To second these views, so highly commendable and salutary, should be the duty of every one, who is able to contribute any remarks to the stock of general information. Under this impression, I have been induced to throw in my mite; and if the observations which I have to offer to your Lordship and the Board, should be deemed worthy of the least regard, I shall feel the greatest satisfaction in having communicated them.

Before I enter upon the general question, I beg leave to make a remark or two by the way. And first of all, it may be proper to observe, that in this country, the quantity of grass land should always bear a due proportion to that of arable; that is, the value of hutchers' meat should always bear a due proportion to that of corn. For the most part, however, there is much difference between them; for the poor live chiefly on *bread*, and buy very little meat. This disproportion is still more obvious, when it is considered, that the consumption of meat in many families, especially amongst farmers, is less now than formerly, on account of the increasing custom of using potatoes with it; and for this reason, and many others, the growth of potatoes cannot be too much encouraged.

Milk is the produce of grass land in general, and is, I think, the cheapest food used in a farm house; the consumption of it should therefore be so regulated and extended, as to make it the cheapest food in a cottage; and one way of doing this, might be, by proposing it as a question, to determine the different profits of a milk and feeding pasture, for a number of years in similar situations.

The annual produce of a milch cow, in, or near any large town, is of very great value, and in these instances the profit seems greater to the owner, than that of any other cattle whatever; and yet the complaint is, not against the price, but the difficulty of procuring a supply.

We hear much of stall-feeding beasts both in summer and winter, and this undoubtedly would be a great improvement in the maintenance of such stock; but many years will have elapsed before this custom be brought into general practice. On this account, therefore, and for the other reasons assigned, I would beg leave to observe, that we should be cautious, how we diminish the due proportion of grass land in this country. I am the more readily inclined to mention this precaution, as it appears to me, to be in part the drift of the following question, proposed by the Board, when they require a system of crops, commencing from and ending in grass, and the management to be such, that the land shall not thereby be in the least impoverished.

"To examine into and report the best Means of converting certain Portions of Grass Land into Tillage, without exhausting the Soil, and of returning the same to Grass, after a certain Period, in an improved State, or at least without Injury."

To meet their wishes in this respect, however, I would offer a system of crops of only two years continuance; the first year potatoes, and the second barley; and it will be, I think, on an explanation of the management, not only promising for good crops, but applicable to almost all kinds of soil, where the land is well drained, and the subject capable of, or proper for, tillage.

Let the course of husbandry be as follows: first, plough the middle part of the lands to one-sixth of their breadth, and pare off the sward on the remaining part; then lay unslacked lime, on the middle ploughed part, at the rate of two and a half chaldrons an acre, and cover the lime with the whole of the sods pared off, forming a bank of equal dimensions, top and bottom, and making the breadth of it rather less than the ploughed part. After the sods are gathered off, plough the lands for potatoes, and the earlier the better, if the soil be a clay. Set the potatoes in the middle of May; but if the bank should not be proper to plant them on, the loss, on that account, will not be more than one-ninth of the field. In the beginning of winter, should the land not be of a rich quality, lay parallel to the sod-bank a quantity of rotten dung, or ashes, at the rate of five tons an acre; then plough the sod-

bank, and mix the manure with the sods and lime, and in throwing up the sides of mixture, form the new bank of less breadth than the former.

In the spring of the year when the field is ploughed, and a few days before the sowing of barley and grass-seeds, spread the mixture on the land; this manure will be good for the ensuing crops, particularly for the grasses, as being the best preparation for making the surface of the field, a fine tilth. For sandy land, not bearing a rent of fifteen shillings an acre, some additional management is to be recommended, viz. that the unslacked lime should be first mixed with ditch earth or other good soil, and when the lime is fallen, the mixture should be laid on the middle ploughed part, as before stated.

If wheat in any of the soils be preferred to barley, the best method of managing the sods and lime, would be, to mix the manure with them at the time of planting the potatoes.

There is, I think, no better method of using lime, than the mixing it first with rich soil, and letting the mixture lay for two or three months in the form of a bank; for by once turning with the plough, the lime will be completely fallen, and the whole in excellent order for spreading on the ground. I find, by experience, that two parts clay, and one part lime, mixed in this manner, will receive an increase of bulk in the proportion of five to eight.

In some cases it may be convenient to raise an additional supply of corn by other means, than the breaking up of grass land; as for instance, I have, in my own farm, a field of seven acres, which ought to be, in the regular course of husbandry, fallowed, manured, and sown with turnips; but the land being in tolerable condition, and having very little twitch in it, I purpose ploughing it two or three times, and sowing it with peas of the soup kind; the drills to be made by the plough, but the sowing, covering, and earthing of the peas to be performed in the same manner as *they are in gardens*. After the peas crop, the field is to be well manured, and ploughed properly for barley, and grass-seeds in the following spring. Barley, in this instance, is preferred to wheat, because the land will be in better condition for the winter fallowing.

This plan of sowing peas, instead of turnips, is adopted, not altogether on account of the high price of corn, but partly with the view of putting off the turnip crop to a more distant period; for our arable land has of late years produced them "grape-rooted," and though this may have happened in cases, where there has been an

intervention of two or three years in grass, yet, I am of opinion, that this disease in the turnip is, in some measure, owing to the seed being sown too frequently on the same land.

In the course of crops just stated, there is, it must be confessed, a deviation from the general mode of husbandry, which I feel rather unwilling to publish, as an alteration, in that respect, should be made at all times with the utmost care. For he is, I believe, in general, the best farmer, who most closely follows the best practice of the country in which he lives; since tried and repeated experience has warranted the mode of husbandry which each neighbourhood pursues.

Having mentioned the drilling of peas, I beg leave to make one remark, on the drill and broad-cast husbandry. If the land be in high condition, and the season proper for sowing, the drill-husbandry is probably to be preferred to that of the broad-cast; but if the land be in an indifferent state of cultivation, the broad-cast is to be preferred to that of the drill; as it is better, I think, in such a case, to depend on the quantity of seed sown for a crop by the broad-cast method, than on a less portion of it, however, judiciously or properly placed in rows by the drill machine.

It is to be lamented, that the improvement of the country should proceed so slowly; but this is to be accounted for, from three general causes, a want of industry in the farmer, of money to be employed in the farm, and also of security to the tenant for sums advanced in any superior cultivation of his land. The consequence of which is, that a great portion of the country continues in the same unimproved state, which is a great loss to the community. For the difference of crops in lands in an indifferent and superior state of management, may, on an average, be estimated at from one-fifth to one-third more, than what such lands now produce; and this deficiency is the more to be regretted, when we consider, that the gain will not be less than from £15. to £20. per cent. on the principal, employed in a better cultivation of land.

By the inclosure of commons, and other uncultivated grounds, the produce of the country now, is much greater than it formerly was; and therefore such inclosures deserve every possible encouragement.

But in offering these remarks on the better management of land, I must not forget to observe, that there is, in my opinion, very often more economy in the owners and occupiers of farms laying out sums of money in lands already inclosed, than

the same sums towards inclosing and cultivating new lands; for the expences of an inclosure in all its parts are so great, that the profit in a number of years, on lands so inclosed, is seldom so much, as that on old lands in a high state of cultivation.

1. "*To explain the Cases in which it may be eligible to drain Land previous to
"Tillage."*

On this first article I would observe generally; that in under-draining, where the springs lie unequal, there is, I believe, no method so good as that practised by Mr. Elkington. But we see the work sometimes injudiciously done, when the areas to be benefited by the under-drains are made too large, so as, in some measure, to supersede the use of deep open drains, which should never be done; for wide and deep open drains, in natural situations, are of all others the most useful, not only in their operation, by working at all depths, but in correcting and bettering the use of the under-drains already made.

Draining by the plough, called the mole-plough, is very often successfully performed, both in grass and arable land, not of a loose texture, and tolerably free from stones. The plough acts by pressure at twelve inches deep, and forms by the mole a tube of about two inches diameter.

There are several kinds of land, both of sand and clay, that have their subsoils of such an impenetrable texture, that they will not permit the moisture to pass through them, and the consequence is, that the top soils are greatly injured, by being starved, poachy, and unsound; and no sort of drains can effectually cure this disease, until the subsoils are made loose and penetrable to receive the rain; and this work of breaking and loosening them, is performed in the following manner. I have a plough without a share or mould board, that has two coulter fixed in the beam, fourteen inches from each other, the bottom ends of which, are joined to another coulter placed edge-way, and in an horizontal direction. The use of this plough, is to follow the common plough in the same furrow, thereby working solely in the subsoil, breaking and loosening it without altering its position, or mixing the top and bottom soils together. The plough is regulated by a wheel at the end of the beam, and will work in this unfriendly subject from six to fourteen inches deep.

2. "In what Cases paring and burning are advantageous, with Directions thereon, regard being had to the subsequent cropping?"

On paring and burning, it would be difficult in any case to prove, whether the ashes of the sods, are preferable to the sods themselves properly meliorated into soil. The greater number of instances would, I think, be in favour of the meliorated soil; for when we hear of the success of paring and burning, it is almost always from car lands that have a *peaty bottom*, or from pastures that have a rough and uneven surface; but the advantage seems to be produced from the *paring only*, for the land being thus cleared of its rough and uneven surface, after it is ploughed, lies more compact and dry, and is therefore better prepared to nourish and support the seed for the ensuing crop, than by having its own uneven surface inverted.

By the ashes being spread on the ground before ploughing, the farmer is too often inclined to plough shallower than he otherwise would do, and thereby gives up a real advantage for one less certain, and probably of less value.

And, therefore, instead of the ashes being spread on the ground before ploughing, would it not be better to place the sod-hills in rows near each other, so that the land may be ploughed, and then the ashes spread upon it? Their salts would then mix properly with the best soil, by their easier solution from the action and moisture of the air.

3. "The Depth to which Grass Lands should at first breaking up, be ploughed."

In all kinds of soil, the depth, to which grass lands should be first ploughed, depends chiefly on the three following things: first, on the nature of the seed to be sown; secondly, on the quality of the subsoil; and thirdly, on the tillage and manure, which the land is to receive during the course of the arable system.

We find, by experience, that wheat requires more soil than oats; but it must be difficult at any time to prescribe the exact depth to which land should be ploughed for wheat, as it depends entirely on the *stratum* and quality of the soil. The rule in ploughing for oats is more easily ascertained; the right depth in general being, I think, where the small roots of the grass, end. If the land is to be kept in a high state of cultivation, both in its tillage and quantity of manure, the land should be ploughed deeper than it commonly is; otherwise, how can we account for the different depths of working by the plough and spade?

From the reasons I have given for the depth, to which grass land ought to be ploughed, I am led to observe, that the produce of land, both in gardens and fields, is nearly in proportion to the labour employed; and if so, the better management of field land, and the more extensive cultivation of gardens, deserve from the public the greatest encouragement. Now the value of labour employed in agriculture is found, by considering the proportion it bears to the real value of the land; that is, by comparing the value of the produce (deducting that of the straw, and of the seed to be sown the ensuing year) with the rent of the land, due regard being had, that the tenants do receive, in all cases, an equitable profit.

The value of neat produce, should be in rent, from

$4\frac{1}{2}$ to $3\frac{1}{2}$ years,	for sand land	from 25s. to 40s. per acre.
6 to 4	ditto, for sand land	from 10s. to 20s.
7 to $4\frac{1}{2}$	ditto, for clay land	from 10s. to 30s.
15 to 10	ditto, for garden ground	from 40s. to 60s.
22 to 15	ditto, for garden ground	from 25s. to 40s.

The average value then of the estimates on field husbandry is near $4\frac{1}{2}$ years rent; and if this be divided into nine parts, there will be seven of these, for the price of the labour, and two for that of the land.

The average value of the estimates on garden husbandry is nearly sixteen years rent, making fifteen parts for the price of labour, and one for that of the land.

These conclusions on the value of labour in the productions of the earth prove, that it is the best source from whence a larger supply of food may be had. And there can be no better method of increasing the quantity of it, than by allotting gardens to the industrious poor, particularly as a great part of such labour is otherwise lost to the community, being performed in the evening hours, after the other works of the day are finished.

In this place I must further observe, that half an acre of garden ground is very often of as much service to a poor man, as a few acres of grass land is for the keeping of a cow: for in the latter case, there is hazard of the cow's dying; and as the cottager has only hay for the winter keep, the expences are greater to him, than they are to a farmer, consequently the profit on such land becomes very uncertain. The expence of a cow at hay, when four guineas a ton, is one shilling a day.

4. "Whether the Crops, intended for Cattle and Sheep are to be fed on the Land,
"and by which Kind of Stock, or carted off."

Potatoes are the first year's crop in the system I have described; and therefore in answering this article, I am led to make the following observations on that valuable root. The growth of them has been of late years much extended, and would have been more so, did not the farmer conceive them to be a great impoverisher of the soil. This might be remedied, in a great measure, if the land was properly cultivated before and after the crop; but the course of husbandry belonging to them, not being sufficiently ascertained, the farmer too often plants them, as an additional crop in the course of his tillage system, instead of growing them one year as a substitute for corn.

Potatoes are valuable, not only as being a cheap necessary of life, but because the profit of them is tolerably certain to the planter, the demand being in proportion to the produce; for a good crop can be afforded at 2s. 6d. the sack of twelve pecks, and at this price, they are proper for the feeding of stock. On hearing, in 1793, that a small part of the potatoe, containing one eye, would answer for a set, I made the following double experiment in a sand field, worth to let 30s. an acre. The experiment was repeated a second time, because little is to be depended upon in any single trial, and less so, when it is performed on a small scale. May 31, 1793, I planted eight double rows with potatoes, the rows being three feet distant from each other, and each row having twenty-six sets at nine inches distance. The weight of the sets in each pair of rows was exactly the same. The produce was taken up and weighed October 30th following.

Double Rows.	Planted.	16 Sets, weight of.	Produce in first.	Produce in second.	Net Produce in first.	Net Produce in second.
		lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
No. 1	Small potatoes whole	0 15½	32 0	24 0	31 0½	23 0½
2	Small potatoes cut into two pieces	0 6½	30 0	24 0	29 9½	23 9½
3	Little pieces with one eye cut from the small end of large potatoes	0 2½	20 0	18 8	19 13½	18 5½
4	Ditto, cut from the large end of ditto	0 2½	14 0	15 8	13 13½	15 5½
5	Great pieces with one eye	0 3	32 0	32 10	29 13	30 7
6	Large potatoes, all the eyes taken out but one in the middle of the potatoe	2 4	34 0	33 0	25 12	24 12
7	Large potatoes with one eye at the small end	8 12½	33 0	35 0	24 3½	26 3½
8	Large potatoes whole	8 6	52 0	35 0	43 10	25 10

In numbers three and four, the sets seem to have been too small: and the produce of the large ones, I think, would have been greater, if they had been planted at a greater distance, which affords some reason for concluding, that if the crop be properly cultivated, the produce in general will be in proportion to the sets planted.

The practice in my neighbourhood is, to have the rows at three feet distance, and the sets at nine inches, and this double experiment was made accordingly. The double rows of number five were planted with the *common sized set*, and the neat produce in each row was nearly the greatest. This, in some measure, proves, that the practice of the neighbourhood is right in the common cultivation of potatoes in fields.

5. *"The Crop with which the Grass-seeds, in each Case, ought to be sown, when the Land shall be again laid down?"*

The answer to this article is comprehended in the answer and observations I have given to the general question.

6. *"The Sorts and Quantities of Grass-seeds for each Kind of Soil, and whether to be provided by Landlord, or Tenant."*

I feel myself very unequal to the answering of this article, having no knowledge of the subject, but what is acquired from the experience of the country; and with the assistance of two or three good farmers, the following sorts of grass-seeds, and the weight of each are specified, as proper to lay down land with.

For clay land, or other strong soils, 14 lbs. of white clover 4 lbs. of red clover, 6 lbs. of trefoil and 2 pecks of rye-grass. For sand, or other light soils to lie two years, 7 lbs. of white clover, 7 lbs. of red clover, 2 pecks of rye-grass, and if pastured the first year, use 7 lbs. of trefoil, but if to be mown, instead of the trefoil, use 4 lbs. of honey-suckle grass, and 4 lbs. of rib-grass. For sand land to lie three years or more, the following quantities are recommended; 14 lbs. of white clover, 7 lbs. of trefoil, 4 lbs. of honey-suckle grass, and 2 pecks of rye-grass.

In the growth of crops, by the operation of the plough, the nutritive powers of land are called forth into full action, and if the land is not supplied by an abundance of manure, the health or strength of them is much diminished; but when the land is again laid down, these nutritive powers are comparatively at rest, and by proper management in that state, are again restored to their former vigour.

So that, if the tenant receives the advantage of the land in its full and undue exertion, he should pay all the expences of having its strength restored, and, therefore, it is right, that *he* should pay for the grass-seeds, and not the landlord.

The situation in which landlords and tenants stand, with respect to each other, should, in many respects, be different from what it usually is. For if a tenant, at will, enters upon a farm in bad condition, and begins immediately to improve and manage it well, he has no security for the *chief* expences, should he quit the farm, before his profits have made their proper return; since, for many of these expences, the common arbitrations of the country, between landlord and tenant, do not attempt to allow. I can speak to the point, having occupied a farm a few years, which, by good management, is now more likely to produce five quarters of barley or three quarters of wheat per acre, than it was at first entering, to produce three and a half quarters of the one, or two and a quarter quarters of the other. Besides, the charges of management *now* are not near so great as they were at the first, so that I am receiving a compensation for the original cost; but if I had been a tenant, and quitted this farm at the end of a short term of years, what arbitration would have restored an adequate share of the expences to me?

7. "Whether it be best to mow or feed the Grass in the first Year after laying down? To detail the Management in each Case; the manuring which may be thought necessary."

The answer to this question probably depends more upon the intrinsic value of hay and grass in each respective neighbourhood, than any material difference it will make to the land, whether it be pastured or not the first year; for we find in general, allowing properly for *manure*, that the ratio of hay produced, is equal to the ratio of the stock pastured. In pasturing, by the frequent eating of the stock, the quality of the grass is improved, but the growth of it is somewhat diminished.

In detailing the management in this case, I have only to say, that the land should be pastured by *sheep and beasts*; that it should not be eat too early in the spring; and throughout the season should be rather under stocked.

This method is proper, not only for the grasses, but also for the sheep; for by having *two kinds* of stock, the farmer is enabled to give his sheep a greater range of ground. If the grasses be kept for hay, it is understood, that the proper season for mowing them is, when the flowers of the best grasses are in full bloom. The hay

should be spread almost immediately after it is mown, and if the weather be fine, it will be ready to be put into cock about the third day, saving itself better in that state, than when spread abroad in the field: and should continue in cock four or five days or more, according to the season and the quality of the crop.

I believe, the improper harvesting of hay originates, not so much from the putting it into cock too early, as the not letting it stay long enough in the field afterwards; in which latter case, the stack is made before the juices of the hay be properly dried.

To manure grass land the first year, is very excellent management, and it should be done early in the winter; and if ever farm-yard manure should be used without having been *billed* to undergo a previous fermentation, it should be on land bearing such a crop as this. For the manure in this state will lie lighter on the ground, and, therefore, not injure the tender grasses; and by its greater quantity will preserve them better from the cold, which is a great advantage, as being the best means of securing a good pasture early in the spring.

8. *"The Principle on which an Increase of Rent ought to be estimated, when permission may be given to break up old Pasture, now under Lease."*

This article applies to two sorts of soil, which may be distinguished by *light* and *heavy*; the former of which are at all times easily convertible into grass; the latter less so. In light soils, if you have an old pasture under lease, and would have but one system of tillage, the course of crops, quantity of manure, quantity of grass-seeds, and after pasturage of the field, may be so regulated, that the increased expences may be in proportion to the increased produce; and the rent in such case should continue as before.

But if on breaking up an old pasture, it is afterwards to continue in the fair husbandry of the country, having the alternate courses of grass and tillage, according to the other parts of the farm, there should be an addition of rent from one-sixth to one-third, and probably more, according as the lease has years to run.

In *strong* heavy soils, it must be very difficult to prescribe any rule, either of rent or management; for the making of a good fallow, and the success of the grass-seeds, when the land is again laid down, are, on account of the seasons, very uncertain; and therefore the converting of such land into tillage, can seldom be recommended. For we find almost always, that the value of the land is very much diminished by

such a change. There are instances, indeed, where the tillage rent is not worth more than half of what the grass rent was.

To keep light soils alternately in grass and tillage, is excellent husbandry, and deserves every encouragement, on account of the increased crops such management produces. In a number of years, the neat profit is from one-third, to one-half as much more, than if the land had been kept constantly in grass, or constantly in tillage.

Sea and river marshes, which are, by the improvement of the country, secure from floods, produce in general, the greatest crops of corn; and when they are laid down again into grass, the seeds flourish remarkably well. This sort of land therefore is, perhaps, the most proper of all others, for raising a larger supply of food.

It must have been observed, by those who have paid any considerable attention to the subject, that there is a wonderful equality between the productions of the earth, and the consumption of them by man, perhaps, more particularly so, in this country.

As an average of the crops, or some little more, is found to be exactly equal to the demand; and these necessities should at all times be used, not only with a sparing and just economy, but with a grateful mind. When we reflect, that our supply depends upon the bounty of a kind and all-directing Providence, whenever this happens to be much less than the demand, we should rest satisfied in the persuasion, that it is designed by the Almighty, to serve some wise and good end, and that with his judgments, he always tempers mercy! for, however distressing the situation of the poor may be, at the high price of corn, we have all of us abundant reason to be thankful, that the late scarcity was not greater. Since, if the drought the preceding summer had set in a month or six weeks earlier, there would have been in the sand districts scarce any crop at all.

As it was, the corn being in the ear, before it suffered by the effects of the drought, preserved itself infinitely better, than if it had been attacked in its more early growth.

Such, my Lord, are the remarks which I have to offer to your Lordship's consideration. In drawing them up, I have studied to be as plain and concise as possible, that they might be the better understood, and more generally useful. I may add that they possess another requisite also, that they are, in general, the result of

my own experience; and in thus presenting them to your Lordship, on this most pressing occasion, I flatter myself I have discharged a duty incumbent on me, as a good subject, and a well-wisher to the interests of my country.

I have the honour to be, with great respect,

My Lord, your Lordship's most obedient,

and very humble servant,

No. XXII.

An Essay on the best Means of converting Grass Lands into Tillage, &c. &c.
By R. Wynne, Esq. of Dublin.

HAVING seen an advertisement from the Board of Agriculture, in which premiums are offered to such persons, as shall produce the most satisfactory essays on "the best means of converting certain portions of grass lands into tillage, without exhausting the soil, and of returning the same to grass after a certain period in an improved state, or at least without injury," I am induced, by the very encouraging manner in which the Board have been pleased to address the public, to submit my sentiments, on the abovementioned subject, to their consideration, and trust they will allow me to communicate my ideas in plain and simple language, never having been in the habit of writing for the public eye.

It has been too common, of late years, for persons to write on agriculture, who have never been themselves engaged in the practice of it, but whose opinions have been formed merely from theory; the consequence (as may be easily conceived) has been, that the young and inexperienced, eager in the pursuit of agricultural knowledge, have been captivated by plausible theories, and have afterwards had the mortification to find that the practice, which had been recommended to them, was unprofitable and erroneous.

I should consider myself guilty of great presumption, were I to offer any opinion on the foregoing subject to the Board of Agriculture, which was not the result of experiments repeatedly made with the strictest attention, and the closest observation. I therefore pledge myself, that the system of tillage, and the course of crops, which I humbly beg leave to recommend, will fully answer, having had ample experience of their effects.

In converting grass lands to tillage, I conceive *the food of man* should be the grand and leading object, and that the greater the proportion of *that food*, produced in a stated time from a given quantity of land, without injury to the soil, the more completely will that object be attained. I believe it is totally unnecessary for me to enforce to the Board, which I have now the honour of addressing, the utility of

potatoes, as food for man, as from the various publications which they have circulated, and the great encouragement, which they have held out for the cultivation of that valuable root, I am persuaded they have a perfect knowledge of its many excellent qualities, not only as food for man, but for cattle of almost every description. In this country we are well aware of the great value of potatoes; the bulk of our inhabitants live almost entirely upon them; and to the failure of the potatoe crop, the dearness of all kinds of provisions in Ireland, is this year principally to be attributed, the corn crop having been uncommonly abundant and productive. Ensure a plentiful crop of potatoes, and every other kind of provisions will most probably be sold at a moderate price.

I shall now proceed to state the course of crops, which I beg leave to recommend. It will occupy seven years, and will furnish three crops of potatoes, three of wheat, and one of red clover, and will, after that period, produce the richest and most abundant crops of grass.

Years.

1. Potatoes planted in ridges with the spade, and dunged.
2. Potatoes in drills with the plough.
3. Wheat sown immediately after the potatoes.
4. Red clover sown in April on the wheat.
5. Wheat on one year's clover ley.
6. Potatoes in drills with the plough.
7. Wheat laid down with grass-seeds.*

This course may in some particulars be varied, according to circumstances, as I shall hereafter point out.

I shall now relate the practice which I have followed in breaking up and draining grass lands, and in cultivating the crops abovementioned; in so doing, I shall endeavour to adhere, as closely as possible, to the directions given by the Board, and trust they will permit me to go minutely into the detail.

Writers on agricultural subjects are too apt to fall into the opposite extreme, and are seldom sufficiently explicit, in describing the different operations of husbandry, which they recommend; the inconvenience arising from this defect, has been felt by almost every practical farmer.

* This course of crops is by no means admissible; it is too severe. *Note by a Member.*

The farm which I hold, contains about one hundred and forty Irish acres,* and is situated within five miles of Dublin. The soil is a strong loam much inclined to wet, occasioned by a retentive subsoil (which in some parts consists of clay of different sorts, and in others of limestone gravel†): before it has been drained, it is very unproductive; after that operation has been effectually performed it is extremely fertile, and yields great crops of almost every kind under proper management.

As the Board desire that persons who write on this subject, shall be particular in distinguishing such parts of the plans recommended, as have been the result of actual experiment, I shall, in conformity to their instructions, state

First, the situation of my farm when I took it; secondly, the present situation of such parts of as I have improved; and, thirdly, the means by which I have effected that improvement.

My farm, when I got possession of it in 1792, was almost entirely *under grass*, which had grown naturally upon wheat, and oat ridges. The herbage consisted of a variety of natural grasses, and a large proportion of blackheads, thistles, wild parsnip, carnation grass, wild hop, fairy flax, crowfoot, &c. &c. The headlands were all so high, as to throw the surface water back upon the fields, which should have flowed into the ditches. The ditches were filled with water almost to the surface of the land; during the winter season, most of the furrows were constantly full of water. These lands produced, on an average, about one ton and a half of hay from the Irish acre, which could not be mown (owing to the coldness and wetness of the ground) till the middle or latter end of August; the hay of a very bad quality, as must appear from the herbage already described, and little or no after grass.

I shall now describe the situation of such of my fields as have been improved and laid down to grass.

The surface of them is so level and smooth, that no trace of the plough can be seen, notwithstanding which, they are as dry *as possible* during the whole winter, even after the most violent rains. I am enabled to mow them by the middle of June, and have great crops of hay as well as after-grass. I mowed one of the fields above described, on the 5th of June last; it produced, by the most moderate

* It is almost unnecessary to mention, that the Irish perch being seven yards, the Irish acre is to the English, as 40 to 30½, or nearly as 5 to 8.

† This limestone gravel is a most excellent manure for our lands, but is extremely retentive till the upper surface of it is broken through.

calculation, five ton per acre, of as fine hay as I ever saw. I mowed it again, notwithstanding the great drought of the season, the last week in August. The second crop yielded at least two tons of hay per acre, of excellent quality. I am perfectly convinced that this field, in the state in which I found it, would not have produced near so much hay in *three* years, as it did this *last season*.

I shall now, according to the plan which I laid down, point out the means which I have pursued to carry the abovementioned improvement into effect.

In land, such as I have already described, any attempt at improvement is totally fruitless till such time as it is *effectually under-drained*, and proper means taken, by *breaking and loosening* the retentive subsoil, to prevent the surface water from injuring the soil; when that object is effected, the farmer who pursues a judicious course, will be amply rewarded for his labour.

Draini^{ng} is now so well understood, particularly by the Board which I have the honour to address, that I fear I shall take up their time unnecessarily, in stating the manner in which I perform that work; however, as it may differ in some respects from the mode commonly practised, and as, I think, the smallest light which can be thrown on a business of so great importance, very material to every farmer, I shall state my ideas on that subject.

Manner of draining Grass Lands, and converting them to Tillage.

My first step is (by procuring a good fall for the water) to empty the ditches, and afterwards to make them as deep as the fall will admit, and to repair them effectually; I then put out the scouring of the ditches and the headlands, on the field, so as to give the surface water a free course into the ditches, level all considerable inequalities and hollows where the water lodges,* and examine the field with great accuracy, particularly after heavy rains, so as to mark out the drains to advantage.

I have already mentioned, that the wetness of my ground is occasioned by a retentive subsoil (I have scarcely any springs), I shall therefore confine myself to the best mode of remedying that defect.

To render land of this sort dry, it is obvious, that wherever the water is collected, and prevented by the shape of the ground from making its escape over the surface, *under-drains* must be made; but where the land is very flat, and has no natural fall, if under-draining alone is resorted to, it will be attended with enormous expence,

* This work may be performed in putting out the headlands.

without effectually answering the purpose; it will, in that case, be necessary to till the land to a considerable depth, in order to conquer the retentiveness of the subsoil, the manner of performing which, I shall presently point out.

Throwing land of this sort into ridges, the mode commonly pursued, in order to remedy the abovementioned defect, is, in my humble opinion, a most pernicious practice, as, independent of the deformity which it occasions, and the great inconvenience of having grass land in this state both for mowing, rolling, &c. &c. the ridge is robbed of its due proportion of moisture in summer, and the furrow is drowned with water in the winter. The system which I follow is diametrically opposite, and will be found to answer most effectually. When the land is under-drained, as already directed, and deep tilled, the more even and smooth the surface can be made, the better, as by that means the water will be regularly divided, and each part having no more than its due proportion, it will be gradually absorbed or evaporated. The winter rains will not in the smallest degree injure the soil; whereas in spring, summer, and autumn, it will receive the full benefit of every shower which falls. To this doctrine I have not found the generality of farmers willing to subscribe; but I can vouch for its truth and efficacy: by putting it in practice, I have rendered my land so perfectly dry in winter, that on parts of it, which were covered with water, during almost the whole of that season, I am now enabled to sow my wheat quite flat under the plough without the sign of a furrow; nothing can exceed the luxuriance of my crops, nor are they affected by the driest summer.

First Potatoe Crop.

When a ley field has been drained and levelled in the manner abovementioned, it should be ploughed in the latter end of October, or beginning of November, to the depth of about three inches, and in the beginning of March following, when the ground is dry, it should be harrowed lengthways, and the potatoe ridges should be marked out.* In the beginning of April, the dung should be laid down, and afterwards the potatoes should be planted. I do not think it necessary to enter minutely into the manner of performing this work, which is so generally understood, but shall make one or two observations on the subject. The width of the ridge and furrow should depend on the nature of the soil and subsoil. Where the soil is a wet loam

* These should be made as much across the drains as possible, so as to conduct the superfluous water to the drains.

or clay, and the subsoil limestone gravel (such as I have described), I should make the ridges narrow, and the furrows narrow also, and very deep, by which means a large proportion of the gravel, which is excellent manure, will be mixed with the soil, and the subsoil will never after retain the water; but where the subsoil is a stiff clay, of a nature which ought not to be mixed with the soil, the ridges should be made narrow and the furrows rather wide, so as to have sufficient covering for the potatoes, without making use of any of the *substratum*. In this case, however, I should dig the bottom of the furrows a full spade deep, in order to render them pervious to water. I endeavoured to perform this work with a mining plough, which was lately brought from England by a friend of mine; but the horses could not work a breast on account of the ridges; and, as it required the strength of six horses, I could not bring them to work steadily one before the other; I therefore was obliged to abandon it. The spade will be found effectual for the above purpose, and will not be very expensive. My principal object in cultivating the first crop of potatoes with the spade is to conquer the *retentiveness* of the *subsoil*, and in cases, where it consists of limestone gravel, to mix as much of it as I can with the soil; otherwise I should always cultivate them with the plough, which is much better in every other respect, and not half the expence. Potatoes should never be planted with the spade in light dry ground, as that mode of culture will not only injure the crop, but destroy the pan, which it is so essential to preserve in dry lands.

The expence of planting an Irish acre with potatoes in ridges is in my neighbourhood nearly as follows. The price of labour being from sixteen-pence to eighteen-pence per day.

300 cart loads of dung, weighing about 7 cwt. each,	£.	s.	d.
at 1s. per load	-	-	15 0 0
1 ton, 10 cwt. of seed potatoes, at 5s. per cwt.	-	7 10 0	
Spreading the dung	-	-	0 10 0.
Planting the potatoes	-	-	3 2 2
Dropping the seed	-	-	0 6 0
Cutting ditto	-	-	0 4 0
Second covering	-	-	1 11 1
	£.	28 3 8	

	£.	s.	d.
Brought over	28	3	3
Hand-weeding - - - - -	0	5	0
Digging out and picking, about - - - - -	2	0	0
Year's rent - - - - -	3	5	0
Ploughing and harrowing the land before planting	0	18	0
	£.	34	11 3

In making the above calculation, I allow the highest prices for every part of the work, and know that it can be executed in such a manner for the above sum, as to ensure a fair prospect of a plentiful crop. The produce of an acre of potatoes, which has been cultivated with care and attention, as above directed, will, on a moderate calculation (unless the season proves very unfavourable) amount to from twelve to sixteen tons;* I shall therefore take the medium, or even the smallest quantity, and form my calculation upon it :

	£.	s.	d.
12 tons of potatoes at 4s. 8d. per cwt. or £4. 13s. 4d. per ton	56	0	0
Expences of planting, &c. &c. as above - - -	34	11	3
Net profit	£.	21	8 9

The price which I value the potatoes at, I consider very moderate. In Dublin market, for the last two years, they have scarcely ever sold under 10s. per cwt. and frequently from that to 16s.; but the profit of £21. 8s. 9d. above stated is nothing, in comparison, to the improvement which the land receives; the great profit arises from the subsequent crops.

It will be proper here to remark, that where rich sound pasture lands or meadows, which have at different times been dunged upon the surface, are to be converted to tillage, it will not be necessary to make use of any dung in planting the first crop of potatoes; but in that case, the land should always be pastured the summer previous to ploughing it up.

If grass land is in a very rough uneven state, infested with weeds, rushes, furze, &c. instead of breaking it up with potatoes, I should (after it had been drained as above stated) recommend a summer's fallow, during which operation all the roots and

* I have known twenty tons produced from an acre

dirt of every description should be collected and burnt upon the borders of the field; afterwards it should be tilled deep, and the ashes spread before the seed-ploughing for wheat. I should likewise lay on from sixty to eighty barrels of lime,* if it can be procured conveniently.

Second Crop of Potatoes.

After the first crop of potatoes has been dug out and carried off the ground,† it should be immediately ploughed, and left in that situation during the winter; as soon as the weather is dry and settled in February or March following, the furrows should be ploughed down, and the field cross-harrowed; after which it should be cross-ploughed to the depth of five or six inches, but not more; the furrows should be again ploughed down and the field harrowed, so as to leave the surface even and smooth. The subsequent management of this crop should depend upon the manner in which the former one had been treated; if it had been dunged, as above directed, little or no dung will be necessary for this crop;‡ but if the first crop has been taken without dung, it will be necessary to make use of a good dressing (150 loads per acre) for the present crop. If the field has been fallowed,§ the wheat stubble must be ploughed in October, and afterwards harrowed, cross-ploughed, and well dunged for the drill potatoes, as above. I shall not here describe the manner of planting the potatoes for the reasons which I have already given, but shall merely state the expence and produce of this crop.

	£.	s.	d.
Twice ploughing and harrowing	-	-	1 16 0
80 loads of dung	-	-	4 0 0
16 cwt. of potatoes at 5s. per cwt.	-	-	4 0 0
	£.	9 16 0	

* The measure commonly used in the neighbourhood of Dublin contains twenty gallons of quick lime.

† If the weather happens to be wet, the land is much injured by carts going over it to carry off the potatoes, I should therefore, in wet weather, recommend that baskets hung on each side of a horse from a straddle should be used for that purpose.

‡ If dung can be procured easily, I should, even in this instance, recommend a little sprinkling in the drills; a very small quantity will be sufficient.

§ And a crop of wheat taken, in the first instance, instead of a crop of potatoes as before stated.

	£.	s.	d.
Brought over	9	16	0
Cutting the seed	-	0	2 6
Spreading the dung in drills, planting, &c.	-	0	16 4
4 times horse-hoeing	-	1	4 0
Hand-weeding	-	0	2 8
Digging out, picking, &c.	-	1	10 0
Year's rent	-	3	5 0
	£.	16	16 6

An acre of potatoes thus planted and tilled will, in all human probability, produce at the lowest computation fourteen ton.

	£.	s.	d.
14 ton of potatoes at 4s. 8d. per cwt.	-	65	6 0
Expence	-	16	16 6
Net profit	£.	48	9 6

The greatest difficulty which arises in this course, is to get the potatoes out of the ground in time for the succeeding wheat crop; this, however, can be accomplished by planting the potatoes in March, and using an early sort, in which case they will be fit to take up by the middle of September; immediately after they are taken off the ground, I would put out about sixty barrels of lime to each acre,* slack it immediately, and spread it as soon as possible; the wheat† should then be sown and ploughed in lightly, either with a turnwrest plough, or in very broad ridges with a light seeding plough, so as not to leave the sign of a furrow. The field should then be harrowed well across. I frequently lay my land down with this crop, in which case, I should sow the grass-seeds immediately; but when it is to be continued in tillage, in the month of March following, the *large* stones should be picked off, and the field should be harrowed with a light harrow, with tines about three inches long;

* If the land has been broken up with wheat and limed, as before directed, of course it will be unnecessary to repeat it.

† I generally sow from ten to twelve stone (of 14lbs.) to the Irish acre, the quantity commonly sown in my neighbourhood is from sixteen to twenty stone, though this is sown on ridges which does not require so much seed as where there are no furrows.

if any weeds appear, they should be hoed, and in moist weather, in the beginning of April, twenty-one pounds of the best red clover should be sown, and the ground should then be rolled with a light roller. The expence and produce will be nearly as follows.

Wheat	Debtor.	Contra	Creditor.
	£. s. d.		£. s. d.
60 barrels of lime at 9d.	2 5 0	Nine barrels of wheat (20	
10 stone seed-wheat at 40s. per		stone of 14 lbs.) at 40s.	18 0 0
barrel - - -	1 0 0	N. B. The straw pays amply	
Once ploughing and harrowing	0 12 0	for reaping, stacking, thrash-	
Picking stones, hoeing, &c.	0 10 0	ing, &c. &c.	
Rent - - -	3 5 0		
Balance being net profit	10 8 0		
	£. 18 0 0		£. 18 0 0

Red Clover.

After the wheat has been carried off, if any weeds appear, they should be taken up: the field should be rolled and shut up till March following, when it should be again rolled. The first crop should be mown for soil or hay, and after the second crop has got well up, it should be stocked hard* with sheep till the beginning of September, when it should be again sown with wheat on the clover ley, exactly in the manner described after the potatoes.

The expence and profit of this crop will stand thus:

Clover	Debtor.	Contra	Creditor.
	£. s. d.		£. s. d.
21 lbs. of clover and sowing	1 5 0	Clover crop I value at	10 0 0
Three times ploughing - - -	0 5 0		
One year's rent - - -	3 5 0		
Net profit - - -	5 5 0		
	£. 10 0 0		£. 10 0 0

* It will be advisable to put all the sheep of the farm on the clover for a few days before it is to be ploughed.

Wheat Crop on Clover Ley.

This crop should be treated in the same manner as the former one, with respect to rolling, hoeing, &c. The expence and profit will stand thus:

Wheat	Debtor.	Contra	Creditor.
	£. s. d.		£. s. d.
10 stone seed-wheat at 40s.	1 0 0	9 barrels of wheat at 40s.	18 0 0
Once ploughing and harrowing	0 12 0		
Hoeing and rolling, &c.	0 10 0		
Year's rent	3 5 0		
Balance being net profit	12 13 0		
	£. 18 0 0		£. 18 0 0

Drill Potatoes.

In October the wheat stubble is to be ploughed, and the field afterwards treated as already directed for the former crop of drill potatoes, with this exception, that a larger dressing of dung should be used, viz. from 120 to 150 loads per acre. The expence and profit of this crop will stand thus:

	£. s. d.		£. s. d.
*Twice ploughing & harrowing	1 4 0	14 tons of potatoes at 4s. 8d.	65 6 0
150 loads of dung	7 10 0	Expence	19 14 6
16 cwt. of potatoes for seed	4 0 0		
Cutting ditto	0 2 6		
Spreading the dung in drills,			
planting, &c.	0 16 4		
4 times horse-hoeing	1 4 0		
Hand-weeding	0 2 8		
Digging out, picking, &c.	1 10 0		
Year's rent	3 5 0		
	£. 19 14 6		
		Net profit	45 11 6

* The land will now be more easily tilled than at the beginning of the course, I therefore charge less for the ploughing, &c.

Wheat Crop, and lay down with Grass-seeds.

Care should be taken to get the potatoes out of the ground very early in September, as I have already mentioned; after which, any unevenness or inequalities in the surface should be levelled with shovels, and immediately afterwards the wheat should be sown, ploughed in as before directed, and remarkably well harrowed previous to sowing the grass-seeds.

Expende and profit as follow :

	£.	s.	d.		£.	s.	d.		
10 stone wheat -	-	1	0	0	10 barrels of wheat at 40s.	20	0	0	
Once ploughing, and repeated harrowing -	-	0	16	0					
Hoeing, rolling, stoning, &c.	1	0	0						
Year's Rent -	-	3	5	0					
Balance or net profit	13	9	0						
	£.	20	0	0		£.	20	0	0

Laying down Ground with Grass-seeds.

Having always considered this to be one of the most material operations in husbandry, I have endeavoured, by strict attention and close observation, to acquire a knowledge of it, and certainly have succeeded so far, as to procure better crops of grass, from ground newly laid down, than any other person of my acquaintance. I shall pursue this subject under the following heads, and state my opinion on each.

First, what season is most favourable for sowing grass-seeds? Second, whether grass-seeds should be sown with a corn crop? if so, what kind of grain is best suited to the purpose? Third, which are the best sorts of grass-seeds to cultivate, and what quantities should be sown? Fourth, how to manage grass-land after laying it down?

First, what is the most favourable season? &c.

I have no doubt that the best time which can be chosen for sowing most kinds of grass-seeds, is the month of August, or beginning of September, but am doubtful whether that season is so favourable for sowing the different sorts of clover, which are very tender in their infant state, and are liable to be thrown out of the ground by severe frost. I however ventured to sow a good deal of white clover, and some

red last September; they promise well as yet, but I shall not attempt to recommend that practice, till I have good reason to be convinced that it will answer. If I had happened to have sown them in spring, the drought of the summer would most probably have killed them.

Second, whether grass-seeds should be sown with a corn crop.

Land which is to be laid down to grass, should be in the richest, and most fertile state possible; sowing corn therefore on such ground will in general be attended with great risque, and if the summer should prove wet, in all probability both corn and grass will be destroyed; but though I have often myself experienced this misfortune, I have never yet been able to forego the prospect of a corn crop with the grass.

I am however clearly of opinion, that, upon the whole, it is the safest practice when land is in a very rich state, to sow the grass-seeds without corn, as by that means you will ensure the crop of grass, which if sown in September, will pay well the following summer; besides you will all along have an opportunity of keeping it free from weeds till the grass has completely taken possession of the ground, which, in laying down grass lands, is a matter of great importance.

If grass-seeds are to be sown with a corn crop, I should certainly prefer wheat to any other grain, for several reasons. First, the grass-seeds can then be sown in autumn. Second, a year is thereby gained in the grass-crop. Third, the wheat straw is of so elastic a nature, that even if the wheat should lodge, so much air will be admitted to the grass, that it will seldom be injured.*

In laying down ground with wheat, I used formerly to sow the grass-seeds in spring, which practice I found defective, as several weeds had previously come up with the wheat, and the land, after the winter rains, is not in that fresh mellow state, which is so essential to the growth of grass-seeds; I, therefore, in the beginning of September last, laid down a field of twelve acres with wheat, and sowed the grass-seeds at the same time, the grass has grown with such luxuriance, that, I fear, the wheat may suffer from it, but rather believe it will not; however, I think it right to suggest any possible danger which may arise, in pursuing the practice that I recommend. If grass-seeds are to be sown with spring corn, I should (contrary to the

* In the harvest of 1799, which was uncommonly wet, an instance of this kind occurred to me, a very luxuriant crop of wheat was laid quite flat, notwithstanding which the grass received little or no injury. N. B. This grass crop was sown on the wheat in spring.

received opinion) prefer oats to barley for that purpose, as I never knew an instance, where barley was sown on very rich land, that it did not lodge and destroy the grass crop. Oats are not so much inclined to lodge, and therefore should, in my opinion, be preferred.

Third, which are the best kinds of grass-seeds, &c.

The seeds, which I have hitherto found best suited to the soil of my farm, are rye-grass, white clover, and trefoil, all of which grow to the greatest perfection. I last spring procured from England, with a good deal of trouble and expence, a pretty large quantity of the following sorts, viz. *alopecurus pratensis*, *poa annua*, *festuca ovina*; which I sowed with great care in April, but they were greatly injured by the drought of the season; however, I hope a sufficient quantity will grow, to enable me to judge how far they are adapted to the soil. A farmer cannot be too particular in the choice of his seed; it is always expedient, to sow a small quantity of each sort in garden pots, and plunge them in a hot-bed, he will then be able to judge, in a few days, how far they are to be relied on.

The kind of grass-seeds which I at present use, are

Rye-grass	56 lbs.*	} to an Irish acre.
White clover	10	
Trefoil	7	

The above quantity is calculated for ground in great heart, and land ought never to be laid down with grass in any other state.

Management of Grass Land, &c.

In order to give proper directions for the treatment of grass land, the first year after laying down, it will be necessary to ascertain, whether it is intended as a temporary ley, or to remain under grass for a number of years; if the former be the case, I should mow it very early in the season, whilst the grass was in flower, and, immediately after the hay was made up, give the field a light dressing of dung, or compost; after which, the after-grass should be allowed to get to a good head, before cattle are put upon it; but if the field is to be kept under grass for a long period, I would not mow it the first year, but feed it off (principally) with sheep; it will come in in fine time for ewes and lambs in spring, and will support a heavy

• Half a barrel of the best rye-grass will weigh 56lbs. I think it better to ascertain the quantity by weight than by measure.

stock; it should be shut up about the 10th of June, and kept so, till the end of October, when it will afford very fine winter feeding, and will answer well for fat wethers which are to be kept over. After this management, the field may be mown the following summer, and will yield an astonishing crop of hay. It is of the utmost consequence during the first year to eradicate weeds and prevent them from seeding.

I cannot too strongly recommend a practice which I constantly follow, and which prevents me from having much labour of that sort; I employ two little boys or girls with baskets, to follow the plough at all times, and pick up every weed they can find; this is attended with very little expence, and is of the greatest utility. I have never found any thing so beneficial to land newly laid down, as the folding of sheep; the fold should be pretty large, and should be moved regularly every two or three days, in proportion to the number of sheep.

In writing on this subject, I cannot but lament the unfortunate prejudice, which so generally prevails, against breaking up old grass land, a prejudice which is not only injurious to the public, but very unprofitable to the individual. Can any system be more injudicious or absurd, than that generally pursued by hay farmers? Without paying the smallest attention to the herbage of their fields (which are overgrown with weeds),† they mow them every year, and once in three years, lay on a large quantity of dung;‡ the consequence of which is, that the weeds are thereby invigorated and multiplied to such a degree, that in a short time they deprive the soil of the benefit, which it would otherwise have derived from the dung, and they are afterwards at a considerable expence, when their meadows are mown, in separating from the grass, those very weeds, which have exhausted the soil without being of any value.

Nothing can, in my opinion, be better calculated to do away this pernicious system, and to open the eyes of prejudice, than the means which have been now adopted by the Board of Agriculture; they will probably receive such information on this subject, as must convince every rational man, that persevering in such opinions is absurd and unprofitable. Having now gone through the course of crops, I shall recapitulate the expence and profit of the whole.

* I here speak of those in the neighbourhood of Dublin.

† Particularly wild jarnip.

‡ Sufficient to produce an abundant crop of potatoes.

Recapitulation of the Expence and Produce of One Acre during the Seven Years Course.

Crops.	Debtor.			Contra.	Creditor.				
	£.	s.	d.		£.	s.	d.		
Draining, levelling, putting out, headlands, repairing and making ditches, &c. &c. &c. one acre with another, I estimate at about	10	0	0	Years.					
1. First potatoe crop	-	34	11	3	1. First potatoe crop	-	56	0	0
2. Second ditto	-	16	16	6	2. Second ditto	-	65	6	0
3. First wheat crop	-	7	12	0	3. First wheat crop	-	18	0	0
4. Clover crop	-	4	15	0	4. Clover crop.	-	10	0	0
5. Second wheat crop	-	5	7	0	5. Second wheat crop	-	18	0	0
6. Third potatoe crop	-	19	14	6	6. Third potatoe crop	-	65	6	0
7. Third wheat crop	-	6	1	0	7. Third wheat crop	-	20	0	0
Net Profit		147	14	9					
	£.	252	12	0		£.	252	12	0

I have omitted to charge tythes and taxes, as I pay the rector of my parish an annual sum for my whole farm, whether I till or not, and the taxes vary every year. There are several other expences attending the management of a farm, which could not properly be brought into the above account.

In making this statement, I have endeavoured to be as accurate as possible, and pledge myself to the Board of Agriculture, that if the course which I have recommended, shall be put into practise on any soil similar to that which I have described, it will be found productive of all the advantages which I have pointed out, proper allowance being made for the difference of prices, according to situation and circumstances; I am aware that in the above course there is not much provision made for the food of cattle, and that the quantity of dung necessary to raise the above

crops, cannot in most situations be procured without such provision; to obviate this objection, I shall mention another course, which I think well calculated to answer the above purpose, but must here observe, that I am particularly well situated as to dung, having water carriage from Dublin, which will I hope enable me this year to plant fifteen Irish acres with potatoes, dunged in the manner I have directed.

Course above alluded to.*

Years.

- | | | | | | |
|---------------------------------------|---|---|---|---|---|
| 1. Turnips | - | - | - | - | On stubble ground fallowed, and a little dung; or rough grass ground pared and burnt. |
| 2. Oats | - | - | - | - | Sown flat under the plough—Red clover sown afterwards. |
| 3. Clover | - | - | - | - | First crop mown for soil—Second fed off with sheep. |
| 4. Wheat | - | - | - | - | On clover ley with one ploughing. |
| 5. Winter tares succeeded by turnips. | | | | | Stubble to be ploughed and winter tares sown—immediately after the wheat is carried off; after the tares are cut, the ground to be prepared, and sown with turnips. |
| 6. Oats | - | - | - | - | Lay down with red clover and rye grass. |
| 7. Clover and Rye Grass | - | - | - | - | Temporary lay. |

By pursuing this course, a great number of cattle may be fed,† and a large quantity of dung collected, most of which may be applied to the potatoe course, as by a slight dressing for the turnips, and by feeding off the second crop of red clover, the land will be preserved in good heart. In soils such as I have described mine to be, it will not answer well to feed the turnips on the land.

So much has been written within these few last years, on the subject of Agriculture, that little novelty can now be expected; I do not flatter myself that this work possesses that merit (if I have any knowledge of farming, it has been acquired from

* I think it right to state that I have not as yet put this course into practice, but have no doubt it will answer.

† They should be fed as much as possible in the house, both in summer and winter.

books,* as well as practice). The only merit which I claim is, that I have made a fair and true statement, founded on practice, and that any person who approves of the system recommended, and wishes to put it to the test of experiment, will neither be deceived, nor disappointed.

Before I conclude, I think it necessary to remark that I did not see the advertisement from the Board of Agriculture until the beginning of this month, and being from the nature of my situation much engaged in business, I have but little time to devote to any other pursuit. I have, therefore, been much hurried in finishing this work against the appointed time, which has prevented me from being as particular in many parts of it as I should otherwise have been, but am convinced I shall experience from the Board of Agriculture every reasonable indulgence.

* I here allude particularly to the Works of Dr. Anderson.

No. XXIII.

An Essay on the best Means of converting certain Portions of Grass Lands into Tillage, without exhausting the Soil, and of returning the same to Grass after a certain Period in an improved State, or at least without Injury. By Alexander Low, Esq. Woodlands by Dunse, Berwickshire.

INTRODUCTION.

INDEPENDENTLY of the desire which a person who has had some experience in the branch of husbandry mentioned in the title, may have to gain the premium offered by the Board of Agriculture, it becomes the duty of every such person, at this time of general calamity and distress, arising from a scarcity of grain throughout the kingdom, to throw in his mite towards suggesting means of relief from the present, and security against the return of a future scarcity; arising, as is certainly the case at present, from inclement seasons.

After the various publications which have appeared, and the report of both houses of Parliament relative to the cause of the present scarcity, and high price of grain; it would only be multiplying words to say any thing more on the subject, as every well-meaning person must be convinced of the truth of what has been *advanced* and stated in these reports, drawn up with so much labour and accuracy, and in consequence of which, the best measures for giving immediate relief and security against real want have been adopted.

It would be equally unnecessary, in this short essay, to say any thing of the growing population of the kingdom, and of the consequent increase of the consumption of grain, or to resort to the general conclusion which has been so fully established of late, namely, "That in the most plentiful years, this country does not produce "grain sufficient for its own consumption."

From the accounts of the imports of grain into the kingdom, for a number of years past, the conclusion seems to be well founded; but this circumstance, if we are to judge of times to come from times past, and in matters of this kind we have in general no better rule to go by, should not lead us to despair of still having cheap and reasonable markets for grain, although we do not grow enough for ourselves.

I have a state of the prices of grain in this county (Berwickshire) for 107 years back before me; but not to have reference to a period when it may be alledged that the population or consumption of the country was not increasing, I shall only observe, that in the year 1761, we had wheat at 2s. 9d. the bushel, barley at 1s. 2 $\frac{1}{4}$ d. and oats at 1s. 1 $\frac{1}{4}$ d. These three kinds of grain rose, but not regularly, till the year 1766, inclusive, when wheat was at 2s. 10 $\frac{1}{2}$ d. barley 2s. 6 $\frac{1}{2}$ d. and oats 2s. 4 $\frac{1}{2}$ d. In the years 1767, 1768, 1769, and 1770, prices declined something regularly, and thereafter rose and fell as in the table of fiars of the county of Berwick.

Candlemas.	1771.	1772.	1773.	1774.	1775.
Wheat - -	£. s. d. 0 18 8	£. s. d. 0 18 10	£. s. d. 1 0 8	£. s. d. 0 17 4	£. s. d. 0 14 8
Barley - -	0 13 4	0 15 0	0 13 4	0 13 9	0 11 6
Oats - -	0 12 0	0 11 9	0 11 3	0 10 9	0 8 0
Candlemas.	1776.	1777.	1778.	1779.	1780.
Wheat - -	0 15 0 $\frac{1}{2}$	0 18 8	0 15 0	0 12 6	0 18 0
Barley - -	0 8 4	0 11 6	0 11 0	0 8 3	0 10 6
Oats - -	0 7 8 $\frac{1}{2}$	0 9 3	0 9 3	0 7 3	0 10 3
Candlemas.	1781.	1782.	1783.	1784.	1785.
Wheat - -	0 16 4	1 1 4	0 18 4	0 19 0	0 17 8
Barley - -	0 10 0	1 0 0	0 15 9	0 15 0	0 13 6
Oats - -	0 8 3	0 15 0	0 12 3	0 12 6	0 10 6
Candlemas.	1786.	1787.	1788.	1789.	1790.
Wheat - -	0 17 0	0 18 0	0 19 0	1 1 4	1 0 8
Barley - -	0 13 4	0 14 0	0 11 8	0 15 0	14 6
Oats - -	0 11 0	0 11 0	0 18 4	0 11 0	12 0
Candlemas.	1791.	1792.	1793.	1794.	1795.
Wheat - -	0 18 8	0 19 0	1 1 0	1 2 8	2 3 4
Barley - -	0 16 8	0 18 4	0 17 0	0 19 6	1 3 6
Oats - -	0 12 0	0 12 6	0 14 9	0 13 6	0 19 0
Candlemas.	1796.	1797.	1798.	1799.	—
Wheat - -	1 1 4	1 0 0	1 0 8	2 16 0	—
Barley - -	1 1 0	0 14 0	0 16 0	1 12 0	—
Oats - -	0 13 0	0 10 6	0 13 9	1 9 0	—

The boll of wheat in these tables, is a fraction more than 4 Winchester bushels; and the boll of barley and oats, a fraction less than 6 bushels.

That these tables are not a criterion for the prices through the kingdom at large, is granted; though now, that there is so ready a communication by good roads, canals, and coasting vessels, there cannot exist a great difference for any considerable time, if the grain is allowed a free circulation: all that is meant by the insertion of these tables is to shew, that the prices have not risen with the increase of population and consumption, which has been gradual; it would seem rather, that the increase of the produce arising from improvements in agriculture meet these in a considerable degree, and that the prices rise or fall from good or bad crops, and therefore the very extraordinary price of grain at present is owing alone to the causes assigned in the Reports of both Houses of Parliament, viz. a failure of the crop in many parts of the kingdom, inclement weather during seed time and harvest, and a more than usual quantity used and kept for seed for crop 1801.

To guard against the unparalleled distress that would fall on the community at large, especially on the lower orders, now that all their funds are exhausted in the purchase of the absolute necessities of life; were the ensuing season and crop to prove unfavorable, like the last, and to reduce the prices to moderation, a more effectual remedy could not be devised, than for the noblemen and gentlemen on both sides of the Tweed, especially on the south side, to give up for a few years, to tillage, a proportion of their parks and old grass lands, which have for many years, some for ages, been consigned to pasture alone, partly from a conviction that old grass in general produces the best beef and mutton, butter, cheese, &c. and partly from a mistaken notion, that these lands cannot be ploughed with profit, or without danger of being deteriorated. I am in this Essay, to endeavour to prove, that old grass lands can be, and have been, converted into tillage with great advantage to the owners, and restored to grass again without diminishing their quality of producing good fat beef or mutton, &c. and without being deteriorated in the least, but on the contrary, much improved. I am, in the first place, to rest this proof on the facts arising from the experience which I have had in the county where I have resided, and practised, as an overseer and farmer for 40 years, and I presume something on the character the county has acquired as a leading one, in substantial improvements in husbandry; and as all experience in matters of husbandry must, from the nature of the thing, be in a great measure local, I shall give the date and the name of the farm,

when and where, the experiments and operations, which I allude to took place, so that the Honourable Board may have an opportunity of ascertaining the facts which I am to narrate; and having done this, I shall go on to detail my experience in other districts through which I have travelled, either with a view to improve myself in the knowledge of husbandry, or to instruct others: and I shall conclude by endeavouring to shew, in various points of view, that it is the interest of the landholders of the kingdom to endeavour by every means in their power to multiply or encrease the quantity of grain in these pressing times, and that this multiplication will be promoted most effectually and speedily, by ploughing up fertile and dry grass lands; for it can hardly be expected, that the occupiers of high upland, or poor lands, will attempt to multiply the quantity of grain this year. They consider that the seed required for an acre costs £.3 sterling, and that they have only a prospect of three after one, for, if happily, which every person must ardently wish to see, the next crop shall be sold at one third of the present prices, they only pay their seed with the crop, and lose their labour.

As it is to be recommended, and no doubt to be wished, that these lands should be restored to grass again as soon as possible with advantage, in order to bring others into tillage in their place, I shall give my opinion respecting the breaking up, and converting into tillage, the other lands mentioned by the Honourable Board; such as commons, downs, &c. But these cannot come in so immediately, to supply pressing wants; as very little of such lands could be prepared for a crop, without a previous fallow and manure. Under wise laws, however, and proper encouragement, they may be brought to meet the encreasing consumption of the country: and it is to be hoped, that the Honourable Board of Agriculture, aided by those patriotic gentlemen who have proposed in the House of Commons, a general law for the division of commons and waste lands in England, will succeed in carrying the same into effect. This will add to the country a great field of improvement, with a consequent increase of the general stock of grain and pasturage, &c. over the kingdom.

Tythes.

Much has been said and written on the subject of tythes, where drawn in kind, operating as a bar against all improvements. In many parts of England it is understood, and should be acknowledged, that the right the clergy have to the tythes is of

longer standing than that of most men to their estates; with respect to tenants, they are only temporary possessors, and have no cause to complain, the rights of the clergy being well known to them before they took their farms. It may be considered, at first view of the subject, as a hardship when a proprietor, or tenant, improves his estate, or farm, that the clergy draws a tenth part of the produce of their improvement; but if a proprietor or tenant has an opportunity of improving his estate, or farm, it is surely absurd reasoning, for the one or the other to say, I will not make this field produce ten pounds an acre more than it does at present, because the clergy, or the proprietors of the tythe, get one pound out of my improvement: with nearly the same propriety may a merchant or man of business say, that he will not add £.100 sterling a year to his income, although it is evidently in his power to do it, because he must pay £.10 out of that £.100 for the support of government.

It appears on strict enquiry, that many of the fine fields in England are consigned to pasture from no other view or motive, but to deprive the clergy, or proprietor of the tythes, of the advantages, that they would derive from such fields being converted into tillage, or corn lands. Such motives as these should certainly give way to general good at all times, but more especially in the present, when it must be evident to every one, that the ploughing up of old or rich pasture grass lands is the most effectual method of multiplying the grain of crop, 1801. In most cases, such lands, at first breaking up, are unfit for wheat; from the late and present favourable seed time, and from the more than ordinary quantity sown for this year's crop, there is every fair prospect of a plentiful crop of wheat next harvest: but it is not wheat alone that is wanted, to relieve the distresses of the poor; barley, oats, and pease, with other grains usually cultivated, are equally necessary for the maintenance of a great part of the community, for carrying on much of the business of the nation at a more moderate expence, and for aiding the revenue.

Having made these remarks, I shall now go on to detail the result of the practice I have had in breaking up old grass lands, and returning them to pasture again, in an improved state.

Experiments in breaking up old Grass Lands.

In the year 1766 I advised the breaking up a field of 40 acres on the estate where I reside (Langton), which had been in grass above 80 years; I advised the ploughing of it, because it was fogged, in consequence of which the grass was late of rising

in the spring. The soil is a rich deep loam incumbent on a dry gravelly bottom, and the pasture through the summer was rich, and produced good fat stock. At that period it let at 25s. per acre.

The field was ploughed in February with a common swing plough, and the furrow taken was from 5 to 7 inches deep, and from 8 to 10 inches broad; It was sown with oats in March, about 5 bushels of seed per acre. The crop was held to be good, the produce being 60 bushels per acre.

The following year, the field was ploughed in December, and sown with oats the 1st of April. The crop during the summer and harvest looked better than it did the former year; however, the end of the harvest proved wet, and the crop shedded much; so that there was considerable loss in cutting it down, but on the whole the produce was 54 bushels per acre. The third year the field was all summer fallowed, the old ridges, which were high and crooked, were levelled by the operation of the plough, and the whole was straightened up into ridges 15 feet broad, and rounded a little by ploughing up twice in the same way; on the whole it was ploughed six times through the season, and in October it was dunged and sown with wheat, at the rate of 3 bushels to the acre, and in May following it was sown with grass seeds, 16 lbs. clover, and 2 bushels of rye-grass seed to the acre, which were rolled in. The produce was 27 bushels per acre, the grain of all the three crops excellent. The following year, 1770, the field was in hay, and the produce 250 stones (of 21¼ lbs. avoirdupois, each stone) per acre, it was then returned to pasture, and the stock of ewes and lambs was more in number to the acre, and as well fed as it used to be, before the field was broke up, though it must be confessed, it did not appear to be so good ox pasture, and it could not well be expected, as the above treatment was very severe, and from the growing knowledge in husbandry, it would be considered much more so now, than it was then. There was no opportunity for marking the progress of improvement on the pasture afterwards, the proprietor having died in the year 1773, and the field having been let as a part of a corn farm. Had such a field been converted to tillage in 1799 and 1800, the value of the produce would have equalled two thirds of the value of the land, reckoning either on the two crops of oats, or on the crops of wheat and hay, as will appear from the following statement.

Forty acres of land at 25s. per acre is £50. which at twenty five years purchase, the common rate of land distant from towns or villages, would bring the price to £1250.

	Bushels.
The two crops of oats were 114 bushels per acre	- 4560
Deduct for two years seed	- 400
Remains for sale	- 4160 bushels
at 6s. amounting to	£. 1218
Deduct for ploughing and harrowing two years	
at 15s. per acre yearly	- £. 60
Shearing or reaping 10s. per acre two years	- 40
Leading home, thrashing, and marketing	- 80
Two years rent of the land	- 100
	<u>280</u>
	£. 968

Taking the other two crops the account would stand thus:

Wheat	-	-	1080 bushels.
Deduct seed	-	-	120
			<u>for sale 980 bushels at 12s. £. 576</u>
250 stones of hay per acre, 1s. 6d. per stone	-	-	750
			<u>£. 1326</u>
Deduct three years rent of land	-	-	£. 150
Working the fallow	-	-	80
Grass-seeds sown	-	-	44
Reaping, leading home, thrashing, and marketing	-	-	60
			<u>334</u>
			£. 992

Nothing is stated for the expence of manuring the field with dung, as the three crops of straw are held to be fully sufficient to meet that expence, and any other not taken into the account, and the after-grass or foggage, the year the field was in hay, did more than pay the expence, which is not stated, of working the hay.

It may be objected to this statement, as not applying to the crops 1799 and 1800, these years being more unfavourable than 1766, 1767, 1768, 1769, or 1770. There is no judging of this, but by analogy; and I shall mention a few facts which

led me to conclude, that had this field been ploughed out in the same situation for crop 1799 or 1800, the crops would have been equal to what they were in the year 1766 and 1767. This year all over this county, and indeed over a considerable part of Scotland, and the north of England, where I have travelled, I observed that all the dry loams, and light soils, on a free bottom, were under full crops, whilst those on the heavy soils, and on lands which had been longer under crop, were very far deficient, and the crops on the thin soils of every description incumbent on a till or clay bottom, were not worth the expence of labour.

Last spring, Mr. Hay, of Drummelzier, ploughed up a grass field, within a mile of one I have described. It was sown with oats early in Mareh, and every judge, who saw the crop before reaping, allowed that the produce would be 12 bolls or 72 bushels the acre; and within the same distance, there were fields of hay producing 300 stones the acre, which were sold off the field at £15. per acre, -but had the hay been stacked, and sold just now, January 1801, it would have produced £30. the acre.

On the estate of Whitehall, the property of Sir James Hall of Dunglass, a grass-field was ploughed up, and sown with Poland oats last Mareh. I viewed the crop for the purpose of valuing it, as it was to be sold. I set it down at 72 bushels the acre; it was sold at the rate of 54 bushels, allowing 18 bushels for risk and working, and in lieu of an obligation on the purchaser, to bring back all the dung arising from the consumption of the straw with cattle, to the ground, which allowance was full; the 54 bushels are to be paid for at the fairs price, which probably will not be under six shillings the bushel this year, thus yielding a rent of £16. 4s. the acre, from which is to be deducted the cost of seed and expences of ploughing and harrowing £2. 15s. leaving of neat rent £13. 9s. Had not the laudable desire of the proprietor, to preserve the dung for the lands, with a view to their improvement, prevented this crop from being sold by public auction, a practice too common in Scotland; it is probable, that it would have sold from £20. to £30. the acre. Crops in Angus-shire, not half the bulk, were sold at that rate this year.

It would have been a great relief to the country had a number of fields of the above description been ploughed up last year. The one last mentioned, about 20 acres, yielding a produce of

-	-	-	-	1440 bushels.
Deducting the seed 6 bushels per acre	-	-	-	120
				left 1320 bushels

go to market. Within a few miles of the field, there were many hundred acres under crop, not yielding more than 18 bushels per acre; comparing the one crop with the other, it requires 110 acres of the last to leave the above quantity of 1320 bushels for the market.

110 acres at 18 bushels the acre	-	-	-	1980
Deduct seed 6 bushels per acre	-	-	-	660
				1320

From this it is evident, that by cropping good lands in place of bad, the saving to the place, as well as to the occupiers, is very great. In this instance, there are 540 bushels thrown away on the seed for bad land, which is taken from the public and there is the expence of labouring 9 acres, which is very considerable, taken from the occupier. But to return to the subject of breaking up grass lands. In the year 1764, Mr. Gavin, of Langton, ploughed up a field of very old pasture; it consisted of 100 acres, the one half dry loam, with a mixture of gravel, the other half a deep loam rather inclined to clay. It was all ploughed with a neat light furrow betwixt Christmas and the middle of March, one-third, or the clay part, was sown with oats, one-third barley, one-third common gray peas, all the crops were reckoned good; the produce of oats 60, barley 42, and peas 62 bushels per acre. The following year, the part last in oats was clean fallowed and dunged, and sown off the third year with clover, rib-grass, and rye-grass seeds, along with barley, and both crops were good; and the fourth year it was hay, the fifth and sixth years pasture. The part which was barley the first year was oats the second, turnips and cabbage the third, barley with grass-seeds the fourth, hay the fifth, and pasture the sixth. The part which was peas the first year was barley the second, oats the third, fallow the fourth, well limed and dunged, barley and grass-seeds the fifth, and the sixth pasture. During the whole course, all the crops were good. Some years after I asked the person who managed the stock, and who had known the field for forty years, being a manager on the estate, if it was hurt by the course of cropping it had undergone; he assured me that it kept a fourth more stock than ever he had known it do in former years, and he heard no complaints of the want of fat, either in sheep or black cattle, so that he thought the field much improved; but the last sown off part was the best, which he attributed to its being limed when in fallow, and not hayed the first year after being sown off with grass-seeds. It was unfortunate that this field was

was not allowed to remain long in grass; it was let in the year 1773 to a tenant, who ploughed it up, and run it out, by which he became bankrupt. The field was then added to my farm adjoining, at 21s. per acre, it was formerly let at 31s. 6d. I gave it a course of fallow, limed at the rate of 140 bushels of lime-shells, dunged at the rate of fifteen cart loads to the acre. On the fallow I had turnips always sown in drills, which were partly eat off by sheep, and partly drawn for cattle. I sowed it off with barley or early oats, and grass-seeds, after the fallow and turnips. The crops of turnips were always good, but the crops of barley, especially in dry seasons, were not heavy. I always had a crop of hay the first year after sowing off—by this time the field had been divided into two. After the whole was laid off and pastured, it improved yearly, and the stock, especially sheep, sold off it, had the first character in the Edinburgh market, where they were generally exposed to sale. Black cattle were fed on the clayey part, or deepest soil; they readily got fat, but I must confess that they did not tallow so well as those fed on an adjoining field of 70 years old grass, at least the butchers alleged so. The adjoining field is a much better ox pasture, having some coarse and boggy land in it, with part watered by natural springs.

Adjoining the farm I occupy, there is a field of forty acres, which the owner wished to improve—it had been long in grass, but was very poor; being a soft clay soil, on a till bottom, with patches of moor interspersed. It was ploughed early in November, cross ploughed in March, breaked and harrowed in April, and it was frequently ploughed and harrowed during the summer. In September it was streighted up into ridges 15 feet broad, and thereafter limed at the rate of 8 cart loads of shells, or 160 bushels to the acre; the lime was harrowed in, in October, and the land was ridged up for seed, and sown with oats the following March; the crop was estimated at 4s bushels per acre. The following year the field was ploughed again for oats, and sown off with grass seeds—the crop yielded 36 bushels to the acre. Thereafter, I rented it in grass at 40 shillings per acre, for three years, which was reckoned a high rent at that time, 1771; the former rent was 7s. 6d. per acre.

As all the labour for this field was hired, and not performed by the owner's own teams or servants, it is easy to state the account of profit and loss, as I have the rate of labour, &c. at that time before me.

First year, 1768.

	£.	s.	d.
To a year's rent	-	-	-
First ploughing, at 5s. per acre	-	-	-
Second ditto, crossing	-	-	-
Third ploughings through the summer, including the seed furrow, 12s.	24	0	0
One breaking, 2s. 6d.	-	-	-
Four harrowings, 2s. each	-	-	-
Gathering and carting off stones	-	-	-
280 cart loads of lime shells, 7s.	-	-	-
Spreading the lime	-	-	-

Spring, 1769.

40 bolls of seed oats, 7s. 10d.	-	-	-
Sowing and harrowing, 2s.	-	-	-
Shearing, 5s.	-	-	-
Leading and stacking, 2s.	-	-	-
Thrashing and marketing, &c. 7s.	-	-	-

255 13 4

Deduct value of crop, 1769,—1680 bushels, or 280 bolls, 9s. 3d. 129 10 0

Balance against the field - 126 3 4

Second Year, 1770.

To a year's rent	-	-	-
One ploughing, 4s.	-	-	-
Forty bolls of seed oats (of 6 bushels) 9s. 3d.	-	-	-
Harrowing and sowing, 2s.	-	-	-
Clover and rye-grass seeds 10s.	-	-	-
Rolling in	-	-	-
Shearing, leading, thrashing, and marketing the same as last year	-	-	-

225 13 4

Deduct value of the crop 1770, 240 bolls, 10s. 3d. 123 0 0

Balance against the field 102 13 4

3 F 2

					£.	s.	d.
				Brought over	-	102	13 4
Third Year, 1771.							
To rent	-	-	-	-	-	15	0 0
Expences of rolling in spring	-	-	-	-	-	2	0 0
						119	13 4
Deduct rent paid	-	-	-	-	-	80	0 0
				Balance against the field		39	13 4
Fourth Year, 1772.							
To old rent	-	-	-	-	-	15	0 0
						51	13 4
By rent paid	-	-	-	-	-	80	0 0
				Balance in favour of the field		35	6 8
Fifth year, 1773.							
By rent paid	-	-	-	-	-	80	0 0
						115	6 8
Deduct old rent	-	-	-	-	-	15	0 0
				Balance as profit	-	100	6 8

Besides the yearly advance on the rent, which however could not be maintained at the £80. but fell down to £40. the £80. was given on account of the first crop of grass being cut for hay. Had this field got another summer fallow after the first or second crop, and been dunged before it was laid to grass, it would have been much more improved.

On the estate of Blackadder, in this county (where I had a direction), there are several fields of stiff deep loam, and some of clay, which had been many years in pasture grass. They could not be let about the year 1778 for more than from 21s. to 25s. per acre; the present proprietor resolved to plough them up, one or two yearly for improving and renewing the pasture. They were ploughed generally in

February, sown with oats in March, the first crop over the whole was not less than 60 bushels to the acre. The second year they were fallowed, dunged, and limed, and turnips were sown on the loamy soil. The crop always in drill was generally eat off by the sheep; after the crop was off, the land was prepared for seed by one or two ploughings, and sown with grass-seeds along with barley or early oats. The seeds being always well chosen, the crops never failed to be good, the clay soils were generally sown on clean fallow with wheat and grass-seeds—in every case one crop of hay was taken. Since the fields underwent this light and improving course of cropping, such of them as are yearly let out for pasture, have gradually advanced in the rent, and keep a much greater quantity of stock now than they did formerly. Some years ago, some of them were at £4. per acre, and last year they were as high as £5. 12s.

Many other proprietors in this and the neighbouring counties have made, and are making great improvements, by ploughing up their grass lands, and those who have had that operation in hand the two last seasons, will be amply paid by their crops.

It is not the general system in Scotland to lock up much land for constant grazing or pasture, and it is fortunate for the country, for if the practice had been as general as it is in some districts in England, there would certainly have been a famine in Scotland this year and the last.

It has been stated that the tythes in England are probably one of the causes of this grass system being so extended, and it may be added, that the reluctance to grant leases will operate as another: for no landlord can give up his old grass lands to be ploughed and cropped, without a certainty that they will be deteriorated by a tenant who possesses from year to year, or at will. From all the experience, however, I have had, and every observation I have made, I am well persuaded that such lands, if not very stiff clays, may be ploughed up for crop, and restored to grass again, without being deteriorated; but, on the contrary, improved, with great advantage to the community in time of scarcity, and also with advantage to the landlord and tenant, without the necessity of granting a lease of longer duration than four or five years.

Mode of breaking up old Grass Lands.

The best mode I know of, for breaking up these lands and restoring them to grass again is as follows. If the soil be inclined to gravel, or sand, plough in the direction

of the present ridges, any time in February, with a neat furrow, from 3 to 5 inches deep, and from 7 to 9 inches broad, and sow with oats in March, harrowing well after sowing, and making furrows with a plough, or ruts with a spade, to carry off the surface water. As soon as the crop is cut down, and carried off, and the gleanings and foggage eaten up with black cattle or sheep, the field should be ploughed up, with a furrow an inch or two deeper than the former; afterwards the field ought to be shut up, to prevent cattle from poaching, till the end of March or first of April. It must then be cross-ploughed, and during the month of May it must be well harrowed and pulverised by frequent ploughings and subsequent harrowings, and cleared of stones; couch quickens, or grass roots, must be carefully gathered and burnt in the ground, or eared off. The field should then rest from the 1st to the 18th or 11th of June, to give time to the annual weeds to vegetate; it should then be dunged as well as the circumstances of the farm will afford, and each day, or yoking, the dung should be immediately spread and ploughed down, and the turnips sown in broadcast or drills, as best meets the opinion of the possessor, or operator; in either case the turnips must be perfectly cleaned, and properly thinned; and ought to be eat off with sheep, and immediately when the crop is off, the land must be neatly ridged up for seed, which may be, early oats, such as Dutch, early Essex, or Poland rye, or barley; after the grain is harrowed in, roll the field, give a single of the barrow after rolling, and sow the grass-seeds, which may be rolled or harrowed in.

4 lbs. of red clover,	}	all well mixed together before sowing, will be sufficient for an acre.
8 white,		
4 yellow,		
2 rib-grass,		
1 $\frac{1}{2}$ bushel of rye-grass,		

Great care should be taken to have the rye-grass of the perennial kind, and not the annual. As I suppose this class of soil has no great fertility in itself but what it has acquired from a long course of pasturage and rest, I do not recommend to take a crop of hay the fourth year, but to pasture it; the additional quantity of stock the land will pasture the first year after being sown off, will pay for the grass-seeds. It would add to the weight of the crops, and the improvement of the pasture, where lime is to be had, to lay 4 or 5 cart loads of shells, well slacked on the field before breaking up, or on the stubble after the first crop is reaped, for this course of improvement (I call it so with confidence) the lease cannot be less than four years, and

the encrease of rent cannot be great, unless the prices in the years when the fields are in grain be very high, but of this I shall speak afterwards.

Four years ago, I let a field belonging to a gentlemen in Roxburghshire, of the kind of soil I here describe; part of it was very old pasture, and part not so old, the lease was for four years after Martinmas 1796, and the articles of management exactly the same as above described, with this variation, that two crops of oats were allowed after breaking up, so that the rotation was,

1. Oats,
2. Ditto,
3. Fallow and dung, with turnips,
4. Barley and grass-seeds.

All the crops were good, those of oats and barley not less than 42 bushels on an acre; and the turnips let to be eat off with sheep at £8. 8s. per acre. The tenant quitted at Martinmas last, so that the proprietor gets the hay crop; but in lieu of this he furnished the grass-seeds, which was proper; if the tenant had been taken bound to furnish them, he ought to have had the hay crop.

This field had been let, for some time before, yearly for pasture, and the rent run from 25s. to 40s. per acre. One year, 1793, it was up at £3. owing to the particular circumstance of its being let for cavalry horses; the rent during the four years it was let out for tillage, was £3. 3s. per acre, and now can be let on lease for pasture at £4.

Light loams, if on a dry bottom, may be ploughed and managed in all respects as these which I have denominated sandy or gravel, with this variation, that spring wheat may be allowed as the last crop.

Heavy or stiff loams, and other soils not clay, should be ploughed soon after Christmas, so as to have a chance of being softened by the winter frost, the usual furrow to be from 5 to 7 inches deep, and from 7 to 9 inches broad. Sow with oats in March, harrow well, and take care to let off all surface water, plough it as soon after the crop is off, as possible, and take the furrow an inch or two deeper than the breaking up one, taking care to form the ridges so as to lay it dry. In the following March plough again, as part of the preparation for fallow; turnips may be sown on such fields as are dry enough to admit being eat off with sheep, or carted without risk of poaching; but the land ought to be well pulverised by frequent ploughings

and harrowings, and well cleaned of weeds and grass roots, dunged and limed before sowing; and it is recommended to sow in drills.

Such of the lands as are too wet and heavy for turnips, may be sown with beans, in drills at 30 inches intervals, so as to give sufficient room for horse-hoeing, provided the land has been limed at the rate of 120 bushels of shells to the acre, immediately after the first crop of oats is cleared off, and after the bean crop is reaped and led home, the land should be dunged and seed-furrowed for wheat, or ridged up for the winter, and ploughed again for wheat, oats, or barley, to be sown in the spring; and with the crop sow a proper quantity of clover and rye-grass seed mixed, viz. 4 lbs. of broad clover, 4lbs. white, 4lbs. yellow, and 4lbs. rib-grass, with $1\frac{1}{2}$ bushel of rye-grass to each acre, will be sufficient. The fourth year the field may be cut for hay, and afterwards returned to pasture; or, to give the tenant a choice in the cropping of this last kind of soil, two crops of oats may be allowed after breaking up, or oats and barley: the third year, clean fallow with dung and lime; fourth, wheat and grass-seeds; fifth, hay. In this case the lease cannot be less than five years.

Clay Soils.

Of these there is a great variety in the kingdom; and where rich deep clays have been long in pasture grass, I confess there is difficulty in breaking them up for a few crops, and returning them to pasture again, without injury to the pasture, though no injury may be done to the soil, yet in many cases it requires long rest to bring some clays to a proper sward, so as they may be termed a good ox or cow pasture.

In my opinion, the best mode of bringing them under crop is to plough up with a full furrow, 7 inches deep and 9 broad, in January, and to sow as early in March as possible with oats, taking care to watch the proper time for harrowing; if the surface is either too wet, or too dry, it will not be pulverised as it ought to be, by the harrows, neither will the seed be properly covered: the land should be again ploughed when the crop is off, or early in the month of November: then, if the field be very clean, and the surface mellowed by the winter frost, it may be sown in March on the winter furrow with barley. The third year I recommend clean fallow, with a good dunging; and afterwards winter wheat, with grass-seeds, watching the proper time for sowing the wheat in autumn, and the grass-seeds in March, harrowing them with a light fine-toothed harrow. If the autumn be wet, so that the wheat cannot be

sown without poaching the land, it may be sown with barley and grass-seeds in the spring, and hayed the fifth year. The quantity of grass-seeds proper, if hay is to be taken, is 8lbs. of red, 4lbs. of white clover, 4lbs. rib grass, and $1\frac{1}{2}$ bushel of rye-grass seeds to each acre. If the land is to be pasture, the first year sow 8lbs. of white clover, 4lbs. of red, 4lbs. of rib grass, and $1\frac{1}{2}$ bushel of rye-grass seeds.

I have seen deep clay lands broke up with success, and cropped thus :

1. Oats;
2. Beans or peas, sometimes a mixture;
3. Barley, with broad clover for soiling;
4. Wheat, the clover lea being dunged;
5. Fallow;
6. Wheat or barley, with grass-seeds.

I suspect, however, that this mode rather tends to deteriorate, and therefore I do not recommend it where the object is to return the land to pasture grass without injury. There are various other modes of cultivating and cropping clay lands, practised with success in Scotland. Some of these are detailed by Mr. Donaldson in his Survey of the Carse of Gowrie; but it is to be noticed that the object there is, in general, to make the land produce the greatest crops, and not to return it to pasture.

The thinner clay soils may be broke up with a crop of oats; 2d, fallow with lime and dung; 3d, wheat or barley, with grass seeds; 4th, pasture.

Poor lands, consisting of a mixture of all the varieties of soil, from moor to clay, ought to be broke up by a clean fallow the first year, breaking and reducing the surface as much as possible by frequent ploughings and harrowing, and after ridging up in September or October, let the lime be laid on, at the rate of 160 bushels of shells to the acre; if dung can be had, so much the better, lay it on after the lime is spread, and ridge up the land for seed,

1. Oats;
2. Peas, or other green crop;
3. Oats or barley, with grass-seeds;
4. Pasture.

It is to be observed that in no case do I recommend the levelling and straightening of high, old, or crooked ridges in the ploughing up of old rich grass lands, which is to be returned to pasture again in four or five years. The ridges, if any be, on the poor lands last described, may be levelled with advantage, but on the richer lands

the loss may be considerable by attempting it. Levelling and straightening ridges can only be effected without loss, where the lands are to be thoroughly limed and dunged after the work is completed, and where the object is not to lay off for long pasturage immediately, but to bring the fields under frequent courses of cropping for a series of 19 or 21 years, which period in most cases, it will require to deface old ridges.

Draining.

In all cases where the substratum is free, and will allow water to pass under ground, draining is proper and necessary, before breaking up any lands for tillage; at least, if not drained before breaking up, they ought to be drained after the first crop, or the year the field is in fallow; but this ought to be done at the landlord's expence, as no tenant on a four or five years lease can go into it; he will rather content himself with a few open drains, made at as little expence as possible to answer for the time.

Where the soils are incumbent on a stiff clay, or till, which holds water under ground, drains are seldom of much use. Open drains and headlands drawn in different directions across the field, in the course the water will go, is more effectual in laying such lands dry.

Paring and Burning.

Breaking up lands for crop, by paring and burning, can only be adopted with success in the following cases. 1st, Where the surface is so stiff with old and unprofitable grasses, rushes, sprouts, &c. as not to be easily reduced by the operation of the plough in the course of a summer fallow, and where the soil is so deep as not to be rendered too thin by a repetition of this practice. 2nd, Where the *substratum* makes better and more productive soil when actuated upon by manures, such as lime, marle, or ashes, than the surface soil does. Moorish grounds having a thin layer of moss or spongy peat earth covered with heath, over a kind of reddish earth, inclined to sand, of which there is much in Scotland, falls under this last description. 3rd, Moss, having a *substratum* of Carse clay.

The operation of paring and burning in the two first cases is nearly the same, the surface is pared into a kind of furrow or "feal," from two to three inches thick, and from 8 to 10 inches broad, early in summer, or as soon as the dry weather sets in: these slices or furrows are cut with spades, called provincially "flaughter spades," or by a plough with a broad feathered sock, both made for the purpose. The slices

are turned over and allowed to remain some time with their grassy side undermost, for the purpose of drying: when dried a little, they are cut in lengths from 18 inches to 2 feet, and set on edge to dry; when sufficiently dried , the pieces now denominated "feal," or turf, are set up in heaps in shape thus  and burnt; during the operation of burning, women and children go through the field to make up the heaps, so that all these feals or turfs may be as much burnt down as possible; immediately after the operation of burning, the ashes are spread and the field ploughed to the depth of from 3 to 5 inches; it is again cross-ploughed and pulverised by frequent harrowing. In October or beginning of November, it is time to give the seed-furrow by ridging up the ground neatly; if the land is dry, the ridges may be 15 or 18 feet broad; if wet, they ought not to exceed half that breadth. If a slight liming is given along with this preparation, or the year after it, the crops will be abundant. Oats are the crops generally taken, and the field is sown off with the second or third crop: where it is sown off with the third crop, the second one ought to be a green crop.

In the third case, viz. that of paring and burning moss, sometimes fire is set to the breast or edge of the moss in dry weather, and if it is not very thick or low lying, it is burnt down to the clay at once; the ashes being spread, they are mixed with the clay by giving it two or three ploughings, and then it is ridged up for seed;—oats are sown, and generally the first and second crops are good, but as these crops are obtained with considerable labour, and from ground that was of no value before, the sowing of oats is generally repeated, if the occupier be a small tenant, till the produce is not equal in quantity to the seed; the land is then left for pasture, and in many places I have seen it very good. It is generally called *burnt land*.

Another method of paring and burning moss is, to cut the surface into "feal," turf, or peat, to the depth of 6 or 8 inches; these peats or turfs are set on edge for drying, and when dry burnt, and afterwards, the ashes being spread, the ground is turned over with a plough, where practicable, and with a spade where it is too deep for horses or oxen to go; it is sown in April with oats, and I have seen these crops very good, not less than 36 bushels to an acre; the sowing with oats is repeated as long as the seed and a little over is produced, which is not above three years. Afterward the ground is sown with hay seeds, oftener not sown, and then left to rest: but whether sown or not, in many cases there is not a particle of vegetation to be seen in the ground for many years after this cropping.

Having detailed the method of paring and burning, I shall now give the result of some experiments which came partly under my own management, and partly under my observation.

Experiments.

Thirty years ago I pared and burnt a piece of haugh land, exactly of the kind I have described in the first case mentioned above. The surface was exceedingly rough, and covered with all kinds of wild grasses, sprots, rushes, segs, and wild-briars, &c. Part was pared with the spade, and part with the plough; the expence was not less than 30s. per acre, besides draining; after spreading the ashes, I limed at the rate of 120 bushels of shells to the acre, and sowed the field in March with oats. The produce was 63 bushels per acre, although there was great loss by uncommon shedding; the second year the field was sown down with pease on the winter furrow, the crop was too strong, and produced nothing but straw; the third year it was wheat, after one furrow, and the crop turned out 36 bushels to the acre: ever since the field has undergone a regular course of cropping, and change, from tillage to pasture, and the crops have always been good.

About twenty years ago, an active tenant entered to a considerable farm belonging to Mr. Kerr of Mories town, on which there were about 80 acres of rough moor, covered with sprots, bent, rushes, and heath, &c. About the one half of this moor was broke up with the plough, got a complete fallow and liming, at the rate of 168 bushels of shells to the acre; the other half was pared with a spade and burnt, at the cost of 21s. per acre, and after ploughing and mixing the ashes with the soil, it was limed at the rate of 144 bushels per acre. The first crop was oats, the second was partly oats, and partly barley, the produce on the burnt part was full one-sixth part better than that on the other, and continued to be so, less or more, for the first round of cropping; but after the land had rested in grass from 3 to 5 years, and was ploughed up again for cropping and a second liming. The crop on the unburnt part was much better than the other; and now that the land is undergoing a third, fourth, and fifth fallow and liming, the crops are considerably better. The same tenant has lately entered his son to another considerable farm in the neighbourhood; in it there are 100 acres of moor, very similar in the surface and produce to what has been described, and better for paring and burning in this respect, that the soil is deeper, and not incumbent on a till bottom, like the other; yet the tenant, who has

had the experience, does not advise to pare and burn, but to fallow and lime in the common way.

Thirty two years ago, I had the direction of the improvement of about 20 acres of barren high-lying moor, the soil was three inches of black earth, covered with short heath, on a pretty deep *substratum* of a sandy kind of earth. The field, after burning the heath, was ploughed in November pretty deep, cross ploughed in the following June, reduced and pulverised by frequent ploughings and harrowings during the summer. In October it was limed at the rate of 140 bushels of shells to the acre, and ridged up for seed, it was sown with oats in March, and the season being favourable the produce was 48 bushels per acre; the field was sown with grass-seeds in two years after, and proved fine sheep walk; soon after it was broke up again by a tenant for two crops, but not being manured it was quite reduced, and lately I measured the heath on the field, and found it 12 inches long.

In the same year, 1768, a tenant within view of the field here described broke up one, similar in all respects except as to size, by paring and burning; he gave less lime by twenty bushels to the acre. His crops were equally good; and the fields having continued in sheep walk since the year 1772, his improvement has the advantage in this respect, that the heath seems to be destroyed, none having as yet made its appearance. A small part of the field, however, was not limed, the crop on it was good for nothing, and just now that part is covered with heath.

On the whole, I conclude, in the 1st place, that paring and burning is an advantageous part of improvement of all deep soils when first broke up from their natural state, and operates as an immediate as well as a permanent improvement.

2nd. Paring and burning at first breaking up of poor lands incumbent on a till, clay, or sand bottom, operates as an immediate, but not a permanent improvement.

3rd. Paring and burning of moss is advantageous in this respect, that good crops of grain are sometimes produced from grounds otherwise totally unproductive, and in situations where the moss can be destroyed altogether by burning, it operates as a permanent improvement.

4th. Paring and burning is advantageous in the improvement of barren moors, where the *superstratum* is moss incumbent on dry earth, and operates both as an immediate and a permanent improvement; but where the *substratum* is clay, I am inclined to think that paring and burning will not be an improvement worth the expence, and it will be better to mix the surface soil with the clay, and give more

lime or other manure. I have had no practice in breaking up old ley grounds by paring and burying; but from what I have seen of it in Yorkshire, and the north of England, I am persuaded that although the ashes may be of use in raising a crop or two of grain, yet the soil must be reduced by it, and I would rather prefer breaking up all such lands with a summer fallow, even in situations where manure cannot be had at a moderate expence. The surface soil and grass roots being well pulverised by ploughing and harrowing, will, in my opinion, afford an equal quantity of food for plants, as the ashes produced from burning; besides, the thickness of the soil is preserved. Where the soil of such lands is very deep and dry, paring and burning, with a view to raise a crop of turnips, to be eat on the ground by sheep, will not only be an immediate but a lasting improvement.

Whether Landlord or Tenant should provide Grass-seeds.

I have already mentioned what I suppose to be the proper sorts and quantities of grass-seeds for each kind of soil. In the case of old grass lands proposed to be ploughed up and cropped for three or four years, and returned to grass again without injury, whether the grass-seeds are to be paid for by the landlord or tenant, depends upon circumstances as well as bargain. If the lands are in lease, and the same tenant is to possess after the course of cropping, which may be proposed, it seems reasonable that he should pay for the grass-seeds, as the additional stock the lands will keep, in most cases, the year after they are sown off, will repay him; but if the tenant is to have no possession of the lands after the last crop of grain is reaped, the landlord ought to provide the seeds; as he alone has an interest in a proper choice.

Mowing Grass Lands.

In all cases, and on all kinds of soil I have mentioned, except the stiff and wet clays, mowing the first crop of grass will be matter of profit, and pasturing it will operate as improvement, provided care is taken, not to allow the field to be poached in wet weather by heavy cattle: sheep are the stock most proper for pasturing new grass, but even these, should not be let into the field till the grass rises in the spring. The management of the first crop of hay (for it is to be noticed that in no case should any field that is to continue in pasture be cut for hay twice) is so nearly the same over the kingdom, that a particular detail here is unnecessary. As a matter of general economy, I think there is no loss in allowing the first crop of new sown grass, on

good land, to be cut the first year after sowing off for hay, provided the tenant is restricted from selling or carrying it off the same estate. In no case, however, ought the hay crop ever to be allowed to ripen its seed.

In sowing off such lands as I have mentioned, to be improved by paring and burning, there should be a greater proportion of white clover than of the others, and hay-seeds may be substituted in place of rye-grass; but in no case would I recommend, to cut for hay any lands of the kind. I by no means approve of hay-seeds, as they are in general nothing but a collection of the seed of weeds.

Crops that may be sown.

Hitherto in this essay I have confined myself, in general, to treat of the breaking up of such grass lands as will give immediate relief to this country, by a great saving of seed, and by multiplying or increasing the quantity of grain with certainty. Oats I have mentioned as the best and surest crop at first breaking up; but I know from experience and observation, as well as information, that many grass fields, especially in England, may be sown the first year with wheat, rye, barley, or peas successfully.

The improvement of the other lands mentioned by the Board of Agriculture, such as sand warrens, heaths, chalk land, and downs, will not give immediate relief, as few or none of these soils will carry a crop worth seed and labour, without previous preparation by fallow and manure. I give no opinion as to chalk lands, having had no experience in the management of them; but the improvement of such soils will certainly, in time, be brought to meet, in some degree, the growing consumption of the country, by the production of more grain, and the maintenance of more stock.

Sand, if there is sward upon it, may be improved by lime, marl, dung, sea-weed, compost, or any other manure usually laid on land; four cart loads of lime shells to the acre will be sufficient, and the more of any other manure the better; these should be spread on the surface before breaking up, the breaking up furrow should not be above 3 inches deep nor 7 broad. Sow first year with rye or oats, and the second year by every means endeavour to get a crop of turnips in broad cast, to be eaten on the ground with sheep, which will fix the sand and improve it very much. If turnips cannot be raised for want of manure, carry them from another field, where practicable, and spread them on the sand regularly. After the turnips are eaten off in either way, seed-furrow the land, and sow with oats early in March, at the same time sow 2 lbs. of white clover, and 3 bushels of rye-grass seeds, or a greater

proportion of hay-seeds, corresponding to their quality; harrow all well in at the same time and roll. Such a course of improvement will certainly encrease the quantity of the pasture, which is all that can be expected. It would be an unprofitable concern to attempt to keep such lands in tillage.

Warrens, which are generally sand, may be managed in the same way, or what will be preferable management for both, plough early in December, cross plough and harrow in March, plough a third time in June, and spread the lime and dung, and plough both down together, and immediately sow turnips and harrow them in. Keep the crop clean, and eat it off with sheep; the next crop may be oats or barley, with which sow the land off as has been directed. Many of the warrens along the coast of East Lothian and Fife, have been profitably encroached upon by this course of management.

Improvement of Heaths.

I have already mentioned two ways of improving heaths, by fallow, paring and burning with lime, or shell, or clay marle, as manure. Shell sand will answer, but lime is best. A few years ago I ploughed up 34 acres of moor, part of my own farm: it was connected with a sheep walk, but produced nothing but a short stunted heath. I ploughed it up with a good furrow in December, and allowed it to remain in that state 17 months, to give time to rot the surface. I then cross ploughed, broke, and harrowed, and during the summer it got three or four ploughings more. In October it was limed at the rate of 120 bushels of shells to the acre, and the lime was harrowed in. In November it was seed-furrowed, and the one half then sown with rye; the other half was sown in March with oats; in April the whole was sown with white clover and rye-grass seeds, which were harrowed in with a brush harrow, and rolled. The crops were tolerable, being 24 bushels per acre, and now the field is good sheep walk. It could not be carried on for crop, being 900 feet above the level of the sea, and 18 miles distant from lime.

I think the best way of improving heaths is to allow them to remain, after they have got the first furrow, twelve months at least before they are fallowed and limed. If dung can be procured, turnips may be raised on all dry heaths, after being fallowed; and if the crop be eat on the ground by sheep, the improvement will be the more complete, and the after crop of oats or barley, good. What has been stated as to the improvement of heaths, warrens, and sandy lands, will, in my opinion, apply to the ground, generally termed *downs*, when the soil is of a light sandy nature.

Increase of Rent.

Having thus given as briefly as I could the result of my experience, observation, and information relative to the ploughing up of old grass lands, and returning them to pasture again without injury, and on the improvement of heaths and other waste lands, it only remains for me to give my opinion on "The principle on which an increase of rent ought to be estimated, where permission may be given to break up old pasture now under lease."

If the rotation be what I have recommended, and the lands be returned to grass in three, four, or five years in an improved state, or without injury, it does not appear to me that an increase of rent should be exacted; especially if these fields of old grass are connected with a farm, consisting of different kinds of soils of an inferior quality. On every well regulated farm an arrangement as to tillage or stock takes place; and every grass field is set apart for the kind of stock best suited to it. When any one of these fields is broke up for tillage, there must be a different distribution of the stock, together with a curtailment of the number; unless where another field has been previously lain to grass, in lieu of the one which is so broke up. Add to this, that the old grass is always the feeding off pasture, and it will often make a material difference to a tenant, to be obliged to market his stock lean in place of fat; besides, derangement in the management of stock is always attended with a temporary loss. This is so well understood that many tenants would hesitate to plough up, their ox pasture, or old grass, even where they have leave to do so, especially in the middle of a lease. Therefore I think an increase of rent ought not to be demanded in cases of this kind.

If old grass fields are at a distance from, and unconnected with, a breeding or corn farm, rented as land for feeding of stock, or grazing cows, an encrease of rent on getting leave to plough them up is reasonably to be expected; and in the present state of markets for grain few tenants will refuse it.

What proportion of the produce of arable land ought to be paid as rent to the landlord? is a question which the Edinburgh Society recommended to the consideration of the public in the year 1753; but notwithstanding the improvements in husbandry were begun, and known in several parts of Scotland long before this period, yet no person communicated their thoughts on the subject, till after a lapse

of 23 years. In the year 1776 Mr. Wedderburn of St. Germans published his thoughts on the subject. His pamphlet I recommend to the consideration of the Board. Though Mr. Wedderburn did not reject altogether the common and popular opinion, then, and in many districts still held, that the produce of the farm ought to be divided into three parts; one third to go to the landlord for rent, one third to the tenant for his maintenance, and one third for labour; yet he gives many statements and tables to shew, that this idea was not correct, and to prove what the rent should be. These statements and tables will not apply to the present question, though, with some alterations, suited to the circumstances of the times, and increased improvements in husbandry, they might be useful in ascertaining the rent of corn farms, reduced to a regular system of management, and course of cropping.

To ascertain the rents that ought to be had for old grass lands let out for tillage, with precision and exactness, seems to be extremely difficult, as it depends upon so many circumstances, viz. the seasons that may follow, the climate, the rate of labour, the situation with respect to markets and manures, the nature of the soil, whether rich and full of manures when formerly laid to grass, the views of the tenant with respect to the disposal of the straw for the improvement of other lands which he may possess, but above all, if the rent is to be in money, it depends upon what no person can know, the prices at which the crops may be sold; fix these prices, which is impossible, and the rent may be fixed with some degree of accuracy. Rents are fixed in general by comparison with the rent of other lands of the like quality that were last let, at full rent, in the same district or neighbourhood, though we often find that speculation in the takers departs from this rule, and the more latitude is given to the tenant, in the way of cropping these old grass lands, the higher he will go, as to rent.

Two years ago, I was consulted by Mr. H. Nisbet, M. P. as to the rent of a park of about 160 acres of old grass, which he intended to let out for four years tillage. The grass rent was about £3. 3s. per acre. I reckoned it then, when prices of grain were not the half of what they are now, worth £6. 6s. per acre; proposing that the crop preceding the sowing off one should be peas, beans, or turnips, after dunging the land; and if turnips, to be eaten on the ground by sheep. The park was afterwards let at £8. 8s. per acre, giving up the obligation to fallow and dung, thereby taking chance of the deterioration of the ground. Here the takers were prompted to give a high rent, by the consideration that their own farms in the neighbourhood would be much benefited by the consumption of an additional quantity of straw.

The soil is loam, in all its gradations from heavy, bordering on clay, to light bordering on sand.

If parties cannot agree about the money rent to be paid for old grass lands, given up to be ploughed, it appears to me that it ought to be a proportion of the crop, paid in kind, or at the average prices in the district. The whole crop may be estimated by judges in Scotland, and the valuers of tythes in England, immediately before shearing. The value of the seed and expence of ploughing for, and harrowing in the seed, which can be easily ascertained in every district, or settled at bargaining, being deducted, the remaining free produce should be divided into three parts; the landlord should have two for rent, and the tenant one for the trouble of harvesting, housing, thrashing, marketing, and risk. Or what will be nearly equal to this, the grass rent, if a fair one, may be doubled, when wheat is at or above 8s. the bushel; and to rise or fall proportionally. In most cases, the landlords will get full rent offered, without risk or trouble of going into valuations of the crop.

Conclusion.

The author of this Essay, from a variety of circumstances, has been prevented from arranging the subject in the order he could have wished, and from stating many experiments which he has seen and made in the course of 40 years practice, as a farmer of lands of considerable extent, and of still more considerable variety, in the kinds of soils and surface; having in his possession heath not worth 6d. per acre, and other lands that may be estimated or valued from 5s. to 63s. per acre; the highest value being for old pasture grass. It may be asked, "Why have heaths in your farm, when you have had such specimens of their being improveable with success and profit?" The answer is obvious; the duration of the lease would not admit of the whole being improved. He has not laboured to be correct in stile, but in facts; he hopes, however, he is sufficiently clear to be understood; and he need not say, what will readily be supposed, that he will be proud if the Honourable Board find this Essay to have merit.

It will give him equal satisfaction to hear that the landholders in England are by any means persuaded to give up part of their parks and old grass lands to be ploughed. The landholders in Scotland have very generally adopted this system some years ago, and none of the noblemen or gentlemen who have done so, have in any case had reason to be dissatisfied. Bringing under crop rich old lands, not stiff clay, is the

best possible means of giving the most speedy relief in times of scarcity. And there is great reason to suppose that the territory of Great Britain, if properly relieved by the legislature from those fetters which lock up so much good, and improveable land, in commons and wastes, and confine it in other districts to be occupied in "run-rig," is fully equal to raise grain sufficient for the consumption of the nation in ordinary seasons.

No. XXIV.

An Essay on the best Means of converting certain Portions of Grass Lands into Tillage, and of returning the same to Grass, after a certain Period, in an improved state. By George Toller, Esq. Twining, Tewksbury.

INTRODUCTION.

IT is the duty of every man, at all times, to use his endeavours to promote the prosperity of his country. His active exertions are loudly called for, when the general prosperity is interrupted; and if the difficulty be of an extensive nature, distressing to all ranks and orders of the community, but bearing more particularly upon the laborious and industrious, who from the nature of things must ever constitute the great mass of mankind, the motives of common charity will demand his talents in aid of the common cause.

The high price of provisions in the year 1795-6 awakened the general attention; and the early recurrence of the same evil seasons 1800-1, has justly been the cause of universal regret and alarm.

Precipitate and thoughtless men, by a conduct (to say the least of it) culpably inconsiderate, have led the attention of the multitude to false and absurd notions of the cause. Instead of teaching them to look to the visitations of Providence, operating upon the increased population of the country, as productive of a scarcity, patiently to be borne, and submitted to with resignation, the people have been told that a necessary body of men, under the absurd appellation of monopolizers, forestallers, and regraters, were withholding from them the blessings of plenty. Instead of persuading them to look for a future and gradual removal of the calamity, they have been taught to expect sudden relief from the deliberations of Parliament. Happy for the country, the people in general have not been led astray, but have seen through the flimsy doctrines that have been preached to them. The wisdom of an enlightened legislature, aided by the voluntary privations of individuals, will doubtless alleviate,

and in time remove the evil. The Parliament has been proof against the clamour of the thoughtless and the ignorant, and instead of enacting arbitrary laws, productive of uncertain present relief, and certainly fraught with future mischief, it has, with a dignified and wise deliberation, gone into the whole important case; having recourse to such immediate measures as a cautious wisdom would justify, but looking to the future to prevent the recurrence of the evil, and for the means of permanent relief.

With the latter object in view, a committee of the House of Lords having addressed itself to the Board of Agriculture, requesting it "to examine into and report "to their Lordships, the best means of converting certain portions of grass lands "into tillage, without exhausting the soil, and of returning the same to grass after a "certain period in an improved state, or at least without injury," and the Board having signified its desire of collecting information upon a subject, which it justly deems of great importance, the writer of the following pages, uniting in a firm opinion of its importance,* and having for some years past directed his views to this object, and given it that degree of attention which has thoroughly convinced him not only of its utility, but also of its practicability, is induced to submit his sentiments to their consideration.

* If the system hereafter recommended had ever been fully brought into practice, the following Essay would never have been called for by the intelligent body of men who have desired information on this subject. The knowledge of the writer cannot therefore have been derived from actual experience in regard to the whole detail of the measures he recommends.

An acquaintance with the late Mr. Curtis first led him to the investigation of the subject. The death of that valuable man prevented the execution of a plan that would ere now have evinced what is here recommended. In order, therefore, to avoid confusion, he begs leave in this place to state, that in regard to the general system, he may be considered as supported by the authority of that experienced botanist. However, where the writer's experience leads him to think differently, he gives his own sentiments freely. The authority of names will never lead him to give up facts. Therefore he will be found, when they are at variance, to adhere to the latter, even against the opinions of the great Linnæus. Thus he asserts that the sheep's foene is not a grass worthy of the attention of the agriculturist; on the contrary, he states the cocksfoot *dactylis* (*dactylis glomerata*) to be an useful grass, notwithstanding the many opinions that are to be found to the contrary.

What he relates respecting the properties and habits of the grasses, and the soil suited to them, is the result of his knowledge of them as a botanist and farmer. His sentiments respecting the course of crops, ploughing, manuring, &c. are merely those of a practical man.

SECTION I.

General State of the Country, in Regard to its Population and Agriculture : Cause of the deficiency of Grain, and a Remedy proposed.

The most permanent source of national wealth arising from its agricultural prosperity, the encouragement of agriculture, should be a main object with every well constituted government.

In infant and rising states, the art and industry of the husbandman by the superfluous produce of his native land, enriches it at the expence of foreign countries; but as population generally increases with the national prosperity, it seldom happens that a powerful and prosperous state can ever, to any great extent, export the necessaries of life. The contrary in general happens, and flourishing communities become dependent on other nations for the supply of their daily bread. However, it is a grand *desideratum* in political economics, that agricultural improvements should keep pace with an encreasing population: without this, a country will occasionally be exposed to difficulties and dangers. Seasons will sometimes be unpropitious; foreign succours may fail; and scarcity, with its constant companion, the dread of famine, will, at intervals, threaten the public tranquillity.

Great Britain in former times derived considerable profits from the exportation of grain. For a number of years past it has ceased, in this respect, to be an exporting country, and has been obliged to have recourse to foreign countries for its own supplies. Of late years the average quantity of grain imported has greatly increased. When adverse seasons have added to the national wants, the quantity imported has been enormous; and the drain of wealth thereby occasioned, must be considered as a political evil of the first magnitude. It has, therefore, become necessary to ascertain the cause of this important change. That the importation cannot have been altogether occasioned by unfavourable seasons, the series of years during which it has continued, will pretty clearly prove. The alteration, therefore, must have originated from one, or both of two causes,—either from our having become less skillful and enterprising in our agricultural concerns, or from the population of the country having increased to such a degree, as to render our former and usual supplies inadequate to the support of the people.

That * the scarcities we have experienced cannot be imputed to the former cause, I may venture to state to be manifest. The study and the practice of agriculture, has been embraced by persons of the most illustrious rank, and of the most enlightened understandings. The convincing example, arising from their improvements, has had the most beneficial tendency: men of learning and fortune have become fond of pursuits so truly worthy of liberal minds. Publications tending to create a love for the science, and recording the improvements introduced into practice, are diffused over the kingdom. Societies for promoting agricultural knowledge have been established in various parts of the country, and as a sort of centre and rallying point for the whole, the Board of Agriculture has been founded under the sanction of Parliament.

Under these auspicious circumstances, it cannot be supposed that the agriculture of the country has been in a declining state. We must, therefore, look to the increased population of England as the cause of the balance which has taken place against us, in this important branch of commerce. As to the extent of that increase, there have existed a variety of opinions. Some have supposed there are six millions of people who use for food the flour of wheat, other authorities compute them at seven millions, and the interesting facts collected by Sir John Call, and the subsequent researches of the Board of Agriculture, seem to prove that there are at least eight millions.

To ascertain with as much accuracy as possible, what is the real state of the population of the kingdom, is a matter of the highest consequence, as upon the knowledge of that fact, the most effectual plans of future remedy must be founded.

Parliament has accordingly taken measures for this purpose. When the result of this enquiry is known, we may ascertain the extent of the means, necessary to prevent in future the recurrence of scarcity.

In the mean time, however, we may be profitably employed in investigating the nature of remedial measures.

Among those which present themselves, no one appears to me of more importance than that submitted by the Board for our present consideration, namely, the bringing certain portions of our grass lands into tillage. When a nation has become populous,

* The number of bills for inclosing the waste lands of the kingdom, which every session of parliament are increasing, strongly indicate the cause to arise from an increasing population.

it is to the operations of the plough that it must look for its supplies. From land in a state of tillage, three times the quantity of human sustenance can be derived than from that in a state of pasture. If, therefore, the supplies are inadequate, the most obvious remedy that presents itself, is to add to the extent of the tillage. From estimating the deficiencies of a number of years, we shall find something like a ground for calculating the quantity of land upon which this change must operate, in order to produce the intended remedy. For this purpose it appears that the average deficiency of wheat during the last ten years would form a criterion from whence to calculate the efforts that are necessary to bring about supplies that will meet the times and seasons.

Without some great and energetic measures, we must reasonably expect a return of our present difficulties.

I shall, therefore, include, in taking the average deficiency, that of the present season, 1801; as well as that of the preceding year, and of the year 1795, in order to judge of a remedy adequate to the mischief.

The annual average of wheat imported during the last ten years will amount to about 350,000 quarters; but in the years of scarcity, the lower orders of the people, from the high price, and the rich, by voluntary privation, were under a system of short allowance, and had recourse to substitutes for wheaten bread. As this also must be within the mischief intended to be removed, we may reasonably state the average deficiency of wheat to amount to 400,000 quarters. To provide a sufficient quantity of wheat to make up this deficiency, would require 128,000 acres of land, reckoning the produce at 25 bushels per acre.* And calculating that in the shift of crops, wheat on the same land would be sown but once in four years,† the whole number of acres to be taken into tillage would amount to about 512,000.‡

From these premises it appears, that to avoid future scarcity, to keep our treasures at home, and to supply our people with bread,§ a number of acres equal to the above calculation, must be taken from the pasturage, and turned into arable land.

* Land newly broken up would in general produce more.

† It would be sown oftener, but I think 500,000 acres would be necessary for a complete remedy.

‡ Comparatively, a small part of the cultivated lands of England; Mr. Young states them to exceed 39 millions of acres. Vide *Annals of Agriculture*. No. 203.

§ This would supply annually about 500,000 quarters of barley and oats, besides beans, peas, clover, turnips, &c.

To this plan there will be doubtless many objections. It will be contended, that by the measure proposed, you will create another evil, as, in order to encrease the corn, you will diminish the cattle of the country.* To a certain extent this may be the case, but the answer is obvious: it is better the rich should buy beef and mutton at 8d. per lb. than that the poor should be in danger of starving; it is better to import wool and hides, than wheat at the enormous expenditure that we have lately done. It will again be contended, that the more obvious remedy presents itself in the waste lands of the kingdom. I acknowledge that abundant means of future resource will hereafter be derived from them; but the improvement of them will be slow, and some years must elapse before their supplies can be expected in the market. The present is a pressing necessity, calling loudly for instant relief: the measure proposed will afford a prompt and efficient remedy. But it will be urged, that by breaking up your pastures, for the sake of a temporary relief, you will introduce a permanent mischief.† When the enclosure and cultivation of waste lands, and the improvements of agriculture now in prospect, have brought a return of plenty, it will be asked, what will then become of the many acres you have so applied to temporary purposes? How can you make up for the loss the country will sustain, by the destruction of so much pasture, which fifteen years of expensive management will not restore to the condition it was in when given up to the plough? If no better system for laying down grass lands could be adopted than the methods which have been hitherto practised, this would be a serious objection, and we should be fearful of the evil that would present itself in the remedy.

But if a plan can be chalked out for restoring those lands to pasture again, whenever from circumstances it should be required, in an improved state, or at least without injury, then I shall insist that the most prompt, efficient, and beneficial resource, presents itself, in converting an adequate portion of our grass lands into tillage.

* From the intermediate crops of clover, turnips, cabbage, &c. there would not probably be a greater diminution than about two-thirds of the number of cattle, during the time the lands were under a course of tillage.

† When these events co-operate with the proposed improvement in laying down grass lands, in the opinion of the writer, we shall again become an exporting country, till we have nearly doubled our population.

SECTION II.

Of the common Methods now in Practice of laying down Arable Lands to Grass.

Somewhat more than a century ago, before the red and white clover, the trefoil, and the ray-grass were introduced into our agricultural system, there was no other plan in practice, for converting arable lands into pasture, than by abandoning them to chance, in the foul and wretched state they were left in by the plough.

Oats,* succeeded by wheat, and that again by oats; or barley, followed by wheat, and that again by barley, were the finishing shifts. In this exhausted state the field was abandoned, the weeds with which it was stored affording an almost useless, perhaps a noxious, food for starveling cattle.

But when a series of years had somewhat restored impoverished nature, the plough was again applied, and three foul and indifferent crops, followed by seven years of barrenness, constituted the wretched system of the husbandman.

After the introduction of what are called the *artificial* grasses,† it became a practice to lay down lands by sowing the seeds of one or other of them, or perhaps a mixture of them, with the last crop. This,‡ for the first or second year, generally made a good return. But after that time it was found that the plants with which they were laid down died away; an unproductive pasture ensued, and much manuring§ and care, and a great length of time, were necessary to bring it to a tolerable state. The plants being perennial, might reasonably have been expected to remain. But the seed itself, or that from which it sprung, having been introduced from foreign||

* I am sorry to know that in some parts of the kingdom this horrible system still prevails.

† Only one, viz. the ray-grass (*lolium perenne*), is, properly speaking, a grass.

‡ Mr. Marshall says, "this is certainly preferable to fouling the turf with weeds." *Rural Economy of Gloc.* Vol. I. p. 166. It is one step above the obsolete custom of letting land lie in its own way.

§ I think with Mr. Curtis, "that it is the extremity of folly to suppose that manure shall produce good plants, if the roots, or seeds of them, were not in the ground before." Yet the manure forming a proper matrix for the seeds of good grasses, when by chance they are carried thither, they flourish, and in time supplant many of the weeds.

|| *Vanum est extrorsum in omnibus economiam nostro solo applicare ejusdem graminum semina, e transmarinis locis ad nos advecta frustra seruntur in nostra gleba. Nostra vero semina extra controversiam sunt preferenda.* LINN. de Peregrinatione intra Patriam. *Amœn. Acad.* Vol. II. 452.

climates, and not being congenial to our soil, became at most but biennial, and disappeared from the land.

This inconvenience gave birth to another practice. As the plants of foreign introduction soon vanished, it was natural enough for the husbandman to have recourse to those of his own country: "But alas, the farmer, instead of distinguishing " and selecting proper grasses for seed, fills his pastures either with weeds or bad and " improper grasses, when, by making a right choice, after some trials, he might be " sure of the best grass, and in the greatest abundance that his land admits of. At " present, if a farmer wants to lay down his land to grass, what does he do? he " either takes his seed indiscriminately from his own foul hay-rick, or sends to his " next door neighbour for a supply. By this means, besides a certain mixture of all " sorts of rubbish, which must necessarily happen, if he chances to have a large pro- " portion of good seeds, it is not unlikely but that what he intends for dry land " may come from moist, where it grew naturally, and the contrary.* Instead of " covering the ground in a year with good turf, it is filled with weeds not natural to " it, and which never would have sprung if they had not been brought there." † By this system, plants of different qualities are indiscriminately blended together, bad and good, noxious and innocent, late and early, some suited to a wet soil, others to a dry, are all thrown into the same land. " Would not any one be looked upon as " wild who should sow wheat, barley, oats, peas, beans, buck-wheat, turnips, and " weeds of all sorts together. Yet how is it much less absurd to do what is equiva- " lent, in relation to the grasses?" " This," says Mr. Stillingfleet, " is such a slovenly " method of proceeding, as one would think could not possibly prevail universally." And if, in his time, " it was wonderful to see how long mankind had neglected to " make a proper advantage of plants of such importance, and which in almost every " country are the food of cattle," how much more astonishing must the continuance of this practice appear in these enlightened days, after the number of years that have

* I myself know an instance of this. A farmer, a neighbour of mine, wishing to lay down a piece of upland ground, procured grass-seeds from his hay, the produce of a low meadow.

The consequence was, that most of the grasses were improper for the soil, and came to nothing; but he had such a crop of docks, with which the meadow abounds, that he tells me he must break it up again, in order to get rid of them.

N. B. The meadow from whence the hay seeds came abounds with the *Alopecurus geniculatus*.

† Vide STILLINGFLEET'S Tracts. Observations on Grasses.

elapsed since his discerning mind had so ably exposed the mischief, and proposed the remedy? Yet certain it is, that lands to this day are exhausted by the plough, and abandoned to the slow efforts of nature to be cropped by chance or accident, or a middle course is pursued, and they are laid down with clover, which soon quits the soil, leaving a sort of chaos behind; or the foul rubbish called *bay-seeds* is had recourse to, and the fields lie (as Mr. Marshall says*) a disgrace to English Agriculture.

SECTION III.

Of the present State of our Pasture Lands.

Whoever has examined the composition of the turf even of our best pastures, must have found it to consist of a heterogeneous mixture of plants. With great justice Mr. Curtis has declared them still to "be pretty much in a state of nature, "full of an indiscriminate mixture of plants, some of which afford good, others bad "food, some good crops, others scarce any crops at all.†" To prove these facts, that able botanist procured small specimens of turf, not more than six inches in diameter, from different downs and commons in Sussex and Hampshire, and carefully cultivated them. They afforded a variety of plants, the far greater part of which were either useless or noxious.

That our pastures do not, on the average, contain more than one-third part of good and useful plants, we may assert with confidence. The list of plants given by Mr. Marshall, as constituting the herbage of the best Gloucestershire meadows, affords pretty good evidence of that fact. But what are these, in point of foulness, when put in comparison with some of our upland pastures? What field is to be found without its host of thistles, nettles, crow-foots, knap-weed, ragwort, mallows, meadow-sweet, silver-weed, &c. &c. to say nothing of the many unprofitable grasses it contains? These the thriftless occupiers of his soil must receive, together with their more deserving neighbours, the bounties of the husbandman. If he manures his field, they must benefit by it. For although (as Mr. Curtis observes) "the strong

* *Vide Rur. Œcon. of Gloucestershire*, Vol. I. p. 159. The two sections of that sensible writer, which treat of the cultivated and natural grasses of the Vale of Gloucester, are well worth the attention of the agriculturist.

† *Vide Flora Londinensis*.

"growing grasses by manuring may overtop or destroy many annual plants, yet those before mentioned, with many others, will grow with their growth, and strengthen with their strength."

Our ancient pastures also, from their age, are apt to become unproductive.* The fibrous roots of the grasses running into each other, intermix in such a manner in old pastures as to deprive each plant of that distinctness of situation (if I may so say) which is necessary to its perfect growth.† This is what is called a matted turf.

Another objection to our old pastures is, that they become moss-grown. For both of which the obvious remedy is the plough. Yet such is the dilemma in which the agriculturist is placed, for want of the seeds of proper plants to lay down his lands again, that he dares not attempt the remedy.

Foul and pernicious, matted and moss-grown, they must still remain: the hidden treasures beneath his old depastured turf must continue useless to himself and to mankind. The time and expence necessary to restore his fields to a tolerable turf again teach him that it is "better to bear the ills he has, than fly to others that he knows not of."

From the benefits that would arise both to the farmer and to the community from the breaking up of such lands, we should naturally conclude that the plants proper for laying down his land were rarely to be met with, and to be obtained with difficulty. On the contrary, the plants for which our cattle have the greatest predilection are comparatively few; the inhabitants of almost every field.

I shall proceed to describe them.

SECTION IV.

Of the Plants necessary to be cultivated in order to constitute a good Pasture.

The plants I shall recommend to the agriculturist for the laying down his land are the following.

* *Mulla sunt (ut dixi) quæ negligentia exolevant et fiunt sterilia: ea expedit interdum etiam frumenti causa exarare, quia talis ager post longam desidiâ latas segetes affert.*

COLUMELLA. Lib. 11. cap. xviii.

† I once heard it asserted that a very old pasture had received benefit by having been badly poached by cattle during a wet winter. I could account for it in no other way than by supposing it destroyed the matted covering, and the holes made by their feet at intervals gave room and distinctness to the plants,

LINNEAN Names.	ENGLISH Names.
1. <i>Alopecurus pratensis</i>	Meadow foxtail
2. <i>Festuca pratensis</i>	Meadow fescu
3. <i>Poa pratensis</i>	Smooth-stalked poa*
4. <i>Poa trivialis</i>	Rough-stalked poa
5. <i>Lolium perenne</i>	Ray-grass
6. <i>Dactylis glomerata</i>	Cocksfoot dactylis
7. <i>Cynosurus cristatus</i>	Crested dog's-tail
8. <i>Avena flava</i>	Yellow oat
9. <i>Anthoxanthum odoratum</i>	Sweet-scented vernal-grass
10. <i>Trifolium pratense</i>	Marle-grass
11. <i>Trifolium repens</i>	White clover
12. <i>Hedysarum onobrychis</i>	Sainfoin
13. <i>Plantago lanceolata</i>	Rib-grass
14. <i>Acbillæ millefolium</i>	Yarrow
Aquatics.	
15. <i>Alopecurus geniculatus</i>	Flote foxtail
16. <i>Festuca fluctans</i>	Flote fescue
17. <i>Poa aquatica</i>	Water poa.

From the foregoing list it will be seen that I have rejected all the late grasses.† An early spring bite, an early hay-making, and consequently the early use of the after grass, are important objects to the farmer.

Besides, the early grasses seem in general to be most coveted by all sorts of cattle. Having omitted the much boasted sheep's fescue, and its near relatives,‡ which have been recommended from the highest authorities,§ I shall think it necessary to make

* The English term meadow-grass being a general one, and at best but ill calculated to describe the whole genus, I have taken the liberty of retaining the generic Linnæan names. How absurd would it be to call the *poa nemoralis* wood-meadow grass, or the *poa alpina* mountain-meadow grass. I have called the *dactylis glomerata* cocksfoot *dactylis*. The farmers having no appropriate names, may be taught to call them by any, and much confusion may be avoided by adhering as closely as may be to the LINNÆAN ones.

† Such are the whole genus *agrostis*, *phleum* &c.

‡ *Festuca duriuscula*, &c.

§ Linnæus, Dr. Anderson, &c.

a short apology. From my own experience, and repeated observation, I am convinced that neither of them are worthy the attention of the farmer. So far from sheep (or any other cattle) being fond of them, they constantly refuse them when any of the above enumerated are to be had. I have carefully watched them feeding in pastures where these species were mixed with the others, and have observed that they cautiously avoid them, and never feed upon them but from necessity.* Upon such barren soils as are unfit to rear any other kinds of grass, they may be useful, and to such I would have them confined.

The grass of the plants I have recommended would in most seasons be fit to mow the latter end of May or the beginning of June, and the seeds of most of them would be ripe early in July.

To avoid referring to plates I have sent specimens of the different grasses.

No. 1. *Alopecurus pratensis*—Meadow Foxtail.

This is one of our earliest grasses. It flowers early in May, and vegetates quickly.† "Its shoots proceed with such vigour (says Mr. Curtis), that it may well be cut three times in a year. Its stalks are strong, and provided with leaves that are soft and juicy. Their taste is, as that of all good fodder grass should be, sweetish and agreeable, having, when made into hay, neither the hardness of straw, nor the roughness and unpleasant taste attendant on some of the grasses: we may therefore consider it as holding the first place among the good grasses, either used as fresh fodder, or made into hay, especially for the larger cattle."‡ The soil best suited to it is sound meadow land, occasionally overflowed: however it will do well in almost any land, except the extremes of wet and dry.

It yields a good deal of seed, which, Mr. Martyn says "may be collected without much difficulty, for it does not quit the chaff, and the spikes are very prolific." But Mr. Swayne says that it is subject to be destroyed by an insect.

There is every reason to believe that in a cultivated state, abundance of seed may be raised from it. What I have sown for the sake of experiment has come up

* The country people in my neighbourhood, who have no name for these grasses, are well aware of their being useless.

† *Flora Londinensis*.

‡ Dr. Fulteney says this is the most grateful of all grasses to cattie. Withering, Vol. II. p. 119.

well. "Lewis Majendie, Esq. of Hedingham Castle, Norfolk, has cultivated it on "a considerable scale, and finds it to be an excellent grass."* "In fine, this plant "has all the requisites of a good grass, viz. quantity, quality, and earliness."†

2. *Festuca pratensis*.—Meadow Fescue.

This grass, though not so early as the meadow foxtail, possesses its other good qualities, and in one respect may be said to be preferable to it: it is adapted to almost every soil, "from the sand fits at Charlton, to the ozier grounds at Battersea."‡ "It yields a sweet and luxuriant herbage, is quick in its growth, and makes good "hay."§ It flowers about the middle of June, and has the recommendation of yielding abundance of seed, which are easily gathered and readily grow.

The Duke of Bedford has cultivated it upon a large scale, but I am not fortunate enough to know the result of his Grace's experiments.

3. *Poa pratensis*.—Smooth-stalked Poa.

This and the following species seem evidently designed by Providence to perform an important part. This in the driest, that in the moister situations.

They resemble each other so much that even botanists were puzzled to find their specific characters, till Mr. Curtis discovered the difference of the sheath scale, that of the *poa pratensis* being blunt, that of the *poa trivialis* pointed. ||

This has been justly celebrated as a pasture grass. "Mr. Curtis says, it is a sweet "grass, and eaten readily by cattle in general, it carries its verdure in the winter "better than most others, and throws out young and numerous shoots in the spring, "so as to make a good spring food. It produces a good crop of leaves at bottom, "which make exceeding fine hay, which is fit for cutting early in the spring."¶

It will grow upon the driest land, and may be seen flourishing on the tops of walls. I have remarked it to be green in the pastures about London, upon a gravelly soil, when every other grass has been parched by drought. It seems to possess the ubiquity of the preceding grass. It flowers in May, and yields plenty of seeds, which are furnished with filaments which cause them to cling together, and render them

* Withering, Vol. II. p. 119.

† Martyn's Miller, ib.

‡ Curtis.

§ Bath Agriculture. Vol. IX. p. 146.

|| Flora Londinensis. N. B. I never found this distinction to fail.

¶ Flora Londinensis.

difficult to sow.* "Mr. Swayne recommends them to be put into newly slaked lime, or order to separate them."† If they were afterwards well rubbed in a sufficient quantity of dry sand, I presume they could be then sown with proper regularity.

This objection to them would only arise when cultivated in a separate state. When mixed with other grasses, the thrashing of the seed would sufficiently separate and mix them.

4. *Poa trivialis*.—Rough-stalked poa.

The chief difference of this grass from the former is in the situation which it inhabits. It is found in low meadows and moist pastures, and never flourishes in a dry soil. It is a proper plant for all irrigated pastures. It affords abundant herbage, and in places suited to it, grows to a prodigious length. It is one of the grasses which constitute the turf of the famous Orcheston meadow near Salisbury plain, where it is said to have been found eight feet in length.‡ It flowers a little later than the foregoing species: the seeds are also furnished with filaments, and should be managed and sown in the same manner.

5. *Lolium perenne*.—Ray-grass.

Upon this grass, Mr. Stillingfleet remarks, "that it is well known, and cultivated all over England, and he hopes that the success we have had with it will in time encourage our farmers to take the same pains about some others that are no less valuable, and are full as easy to be separated."§

It takes a more ample range than the meadow foxtail, as it will flourish in drier soils, and is found to be its companion in our favourite meadows. Though it will grow on very upland situations,|| and is often sown improperly where sainfoin would be the proper plant; yet certainly its natural situation is in a sound mid-land soil somewhat moist.

* These are the wings furnished by Providence to enable these plants to perform their office. By these they are brought to the manure, not by the manure: thus, by slow degrees, they form a good turf on lands in sufficient heart to promote their growth.

† *Gramina pascua*.

‡ Bath Agriculture, Vol. IX. p. 154.

§ Observations on Grasses.

|| The drier upland soils I call upland, the moister mid-land, what is subject to inundation low-land.

From its having been cultivated in improper situations, and from improper seed, a considerable prejudice has been raised against this plant: it is accused of running so much to seed stalks, that after a short time in the spring, it is refused by cattle.

Where it is transported to unnatural regions this may be the case; but those who will take the trouble to examine it in its proper soil, will find it abounding with succulent leaves, that are exceedingly grateful to cattle. Mr. Marshall bears ample testimony to the value of the natural ray-grass. "He describes an extensive whole year's common, stocked with horses, young cattle, sheep, and geese. The site a dead level, subject to be overflowed: * the soil a reddish loam; the herbage ray-grass, saccharine in a superior degree, literally as sweet as sugar, with some white clover, and (from what I can judge by its growth) some marsh bent. It is eaten down so level and so bare, that the geese, one should suppose, could scarcely get a mouthful. Yet the young cattle are as sleek as moles. It is esteemed, I understand, without exception, to be the best piece of land in the country."† Again he says, "The forcing quality of the first spring grass seems to be here well understood. No matter how short the grass at this time of the year, so the cattle can get hold of it, they are sure to thrive amain. The reason is obvious, there is not at that season a blade of any other grass than ray-grass, no alloy to lower its value." Even in its most objectionable state, its quality when made into hay is acknowledged to be good. "Clean hay made of this grass," says Mr. Sole, "is particularly preferable for race horses and hunters, as it does not affect their wind nor blow them as other hay does: and notwithstanding it runs all to bents, yet the juice is so concentrated in them, as to afford greater nourishment. Mr. Croom had a fine crop of it last summer, well got in, and his horses were so fond of it, as to reject the clean corn for it."‡

After all this testimony, we have only to examine our pastures to decide in its favour: no piece of grass land suitable to it should be without a proper share of this valuable plant. It springs very early: and quantity, quality, and earliness, are also its characteristics. It flowers the latter end of May or beginning of June. The grand *desideratum* is, a proper cultivation of the seeds of the indigenous plant, on a proper soil. Mr. Pacey, an excellent agriculturist of North-leach, in Gloucestershire,

* From some such situation the seeds for midland pastures should be obtained.

† Rural Econ. of Gloucestershire, Vol. I. p. 162.

‡ Bath Agriculture, Vol. IX. p. 149.

has cultivated the natural sort:* and his seed is allowed to be vastly superior to that of the shops. When cultivated alone, Mr. Marshall says a gallon of good clean seed is sufficient for an acre.

6. *Dactylis glomerata*.—Cocksfoot dactylis.

A violent prejudice has prevailed against this grass, which I conceive to have many good qualities. By most it is called a sour coarse grass, and Mr. Sole goes so far as to describe it as "a very coarse ordinary grass, refused by all cattle, too common in all pastures."[†]

From the most positive experience, I am certain that so far from its being refused by all cattle, they all eat it, and some are very fond of it. We are too apt to draw positive conclusions from a cursory observation of facts. That this grass is frequently seen in our pastures in coarse patches, for which no sort of cattle have any relish, I readily admit; but I am of opinion that this is the case of almost every sort of grass at particular stages of its growth. That cattle are most fond of the herbage in a certain young state of growth, must have been generally observed. If, therefore, there happen to be in a pasture any particular species which springs early, and outstrips the rest in their growth, which is the case of the cocksfoot,‡ it will be left by cattle for the more delicate morsel afforded by new-sprung plants: hence has the prejudice originated. In a young state of growth, cattle readily eat it, and sheep have a decided liking for it. I have seen them pass over almost every thing else to get at it. It is known that sheep fine the turf of the pastures they feed upon; and this, in respect to the plant under consideration, arises from their partiality for it. In winter they bite down its rich succulent stems to the very crown of the plant, and thereby cause its destruction. In his opinion of the cocksfoot, as an agricultural plant, Mr. Curtis seems to have been undecided. "Mr. Swayne calls it rather a coarse grass but very productive, especially in leaves, and is not disliked by cattle, unless when growing on rank soils."§ Mr. Pacey, whom I have before mentioned, has not omitted to

* I doubt if the soil there is suited to the plant for general purposes.

† Bath Agriculture, Vol. IX. p. 142.

‡ This is a reason for the separate cultivation of it. Whoever would do this, and turn his cattle to it early in the spring, would have his prejudice removed: and were he to leave it for hay, he would have an early and abundant crop of good fodder.

§ *Gramina pascua*.

notice the valuable properties of this grass. He has sown it largely when laying down his lands. It is permanent; his cattle are fond of it, and never reject it, but in that rank state of growth in which all other grasses seem to be disliked by them. It is a very general inhabitant of our pastures; rejecting only the extremes, not flourishing in very wet, or very arid soils; it affords an abundant crop, springs early, and grows fast, and yields plenty of seed, which, as Mr. Swayne properly observes, is not easily shaken out. It flowers in June.

7. *Cynosurus cristatus*.—Crested Dogtail.

This grass will be found useful in the composition of the turf of upland pastures; it affords a wholesome food for sheep; it yields a thick short turf. It flowers in June. The seeds may easily be obtained, and in great plenty.

8. *Avena flavescens*.—Yellow Oat.

This grass is recommended by Mr. Miller next to the poas.

It certainly is an ingredient in very good pastures, and cattle are fond of it. It is generally a companion of the crested dogtail, and much resembles it in its qualities. I should recommend it to be sown with it. It flowers in July.

9. *Antioxanthum odoratum*.—Sweet-scented Vernal-Grass.

This grass is said by Linnæus to cause the pleasing smell of new-made hay. It is certainly very odoriferous, and retains its smell for a considerable time. To give a flavour to the hay seems to be its chief utility, as it will never yield an abundant crop. It is common to almost every soil. It flowers early in May. Its seeds may be readily obtained.

10. *Trifolium pratense*.—Marle-grass. Native Red Clover,

The utility of cultivating our native plants, which I have before recommended, cannot be made more manifest than by attending to the circumstances of that now under consideration. Though botanists have not settled any specific difference between it and the red clover of the shops, there is, however, one distinction of great importance to the agriculturist, viz. the marle-grass is a native plant, congenial to the soil, and perennial; the other, from having been originally introduced from abroad,

and probably in some degree from a change arising from long cultivation, has lost its perennial qualities, and in two years disappears from the land.

In regard to a plant of such great utility as this, it is of the utmost importance that seed should be selected from native plants. Those from our commons and oldest pastures should be obtained for the purpose of raising seed, and every chance of a mixture with the cultivated sort should be cautiously avoided. It has been for some time cultivated.* A Mr. Smith of Somersetshire is said to have had the merit of first setting the example. It cannot be too extensively followed. The plant itself and its valuable properties are too well known to need a description. It is a tap-rooted plant, and feeds at a considerable depth. It flowers in May.

It is best adapted to a midland soil, but is found also in the soundest lowlands.

No. 11. *Trifolium repens*.—White clover. Suckling Dutch clover.†

THIS is one of the most general plants of the country. It is to be found in almost every situation from the lowest meadow to the highest mountain. In soils not calculated to promote its growth, it is so diminutive as to require a particular research, and almost the assistance of a glass to discover it. Hence arises the false notion that certain manures generate white clover: the fact is, they promote its growth, and render it obvious to the superficial observer.

From our having been taught the cultivation of it from foreigners, and the seed having been generally imported from Holland, this plant so universally dispersed over the country, has obtained the name of Dutch clover. From what has before been said it appears suited to almost every soil. In cultivating it for seed, the same caution should be used in choosing native plants, as is before recommended in regard to the red clover.

This plant propagates itself by throwing out roots from the stem joints, and thus extends itself to our pastures. It is well known that all cattle are exceedingly fond of it. It produces a less crop than the preceding. It flowers the latter end of May and beginning of June.

No. 12. *Hedysarum Onobrychis*.—Sainfoin.

The value of this plant upon hilly calcareous soils is sufficiently well-known. It

* Vide Withering. Vol. III, p. 651.

† In Norfolk.

has a strong perennial root, and when cultivated separately, has afforded constant crops of hay for near twenty years.

It is a native of England, and to be found in Cambridgeshire, Hertfordshire, or Epsom Downs, Cotswold Hills, about Malton, &c. in Yorkshire, and other hilly situations and calcareous soils. From these parts plants should be procured and cultivated. It flowers in June and July.*

No. 13. *Plantago lanceolata*.—Rib-grass.

No good pasture should be without this plant. It springs early and is relished by cows and sheep, who are particularly fond of it. I have seen them search for it with great eagerness, biting off the ends of the leaves as soon as they had sprung. A gentleman who had sowed some rib-grass, when it was become a full bite, turned several horses, cows, and sheep, into it. The horses refused it, but the cows fell upon it, as if they had been newly turned out to grass, and not tasted a green herb for months, and, together with the sheep, soon cleared the rib-grass.†

The account given of it by M. Zappa, of Milan, accords with what I have seen of the plant in our best pastures in this country. "He says it grows spontaneously in every meadow of Lombardy, especially in those which are irrigated; that it vegetates early, flowers at the beginning of May, ripens in five weeks, and is eat with the *poa trivialis*: that the height of the leaves is one foot, and of the stalk a foot and a half;‡ that it multiplies much by the seed, and a little by the roots, which it continues for some time to reproduce: that it is eaten heartily by all sorts of cattle, and particularly by the cows in grass;§ and the cows like it best in May, it having great influence on the milk: that the hay is eaten more voraciously by cows, and has a great influence on the flesh; in short, it is one of the best plants either for the milk or for the flesh." || Mr. Young had before cultivated, it; and he and every other observing agriculturist must know its value. It flowers in May and June, yielding plenty of seed.¶

* Vide Martyn's Miller, *Hedysarum*.

† It was late in the summer.

‡ I have seen it of this height in a pasture of mine.

§ Horses seem to have no predilection for it, but eat it freely in the pasture.

|| Annals of Agriculture, Vol. VI. p. 50.

¶ Ibid. Vol. VI. p. 47.

No. 14. *Acbillæ millefolium*.—Yarrow.

The public, I believe, are indebted to Dr. Anderson,* for first encountering the prejudices that were entertained against this plant: he proves most satisfactorily its great utility as a pasture plant: and whoever will give himself the trouble to examine his pastures and watch his cattle, will soon be of the same opinion with that learned agriculturist.

As my own observations accord most thoroughly with his opinions, what I shall add will be for the most part, but a short abstract of his sentiments respecting it. Cattle are so fond of it, that in a pasture tolerably well stocked it is hardly ever suffered to come into flower: it is kept so close that you would hardly suppose that it was a constituent part of the turf. In the cow pastures about London I have been obliged to search for it attentively: but upon a close inspection found it pretty generally mixed with the other herbage. Sheep bite it as fast as it springs.

Is it possible that a plant which cattle so much delight to eat, can be useless? Whether it is serviceable to them as a food, a medicine or a condiment, we should take advantage of our knowledge of their instincts, and furnish them with the means of supplying themselves with a food, which the almighty Giver of that instinct can never have pointed out to them in vain. It is suited to almost every soil. It flowers in June and July, and affords seed in abundance.

No. 15. *Alopecurus geniculatus*.—Flote Fox-tail.

This grass may become valuable from the situation in which it flourishes.—It is a useful link in the chain of nature, intended to connect our fens and morasses and our moister meadow lands. In respect to the degree of moistness, it stands between the rough-stalked poa and the flote fescue. It grows in meadows, on the banks of the Severn, in places so subject to inundation, that the other good grasses are expelled, and there it mixes with the flote fescue. It is found in the moister parts of meadows, the hay of which I know is much esteemed for feeding cattle. It appears likely to be a useful grass for newly reclaimed morass, or lands recovered from the sea. It will require a moist situation when cultivated for seed. It flowers in May and June.

* Vide Anderson's Essays, Vol. II. p. 252.

No. 16. *Festuca fluitans*.—Flote-fescue.

This grows in still moister places than the flote fox-tail.

It may be said to be amphibious, as it sometimes grows in the water, and sometimes in moist places out of it. Horses and cows are so fond of it, that they often endanger themselves to get at it. It springs early, and is likely to be rendered useful for the same purposes as the flote fox-tail. It is a component part of the famous Orcheston meadow. It flowers in June.

No. 17. *Poa aquatica*.—Water Poa.

"This," says Mr. Curtis,* "is one of the largest, and most useful of our grasses; it constitutes a great part of the riches of Cambridgeshire and Lincolnshire, and other counties, where draining the land by means of windmills has taken place. Immense tracts that used to be overflowed and produce useful aquatics, but which still retain much moisture, are by the above process, spontaneously covered with this grass, which not only affords a rich pasturage for the cattle in summer, but forms the chief part of their winter fodder."

† Mr. Sole informs us that "in the Isle of Ely it grows to six feet, and it is usually cut when about four feet high. When dry it is bound up in sheaves: it generally undergoes a heat in the rick, which improves it. It is excellent food for milch cows; horses are not fond of it. The inhabitants there call it "fodder" by way of eminence, other kinds of coarse hay being called "stover." By being cut into chaff I make no doubt it would prove excellent winter provender.

From its strong stem and upright growth it is calculated to remain unhurt by inundations, and is suited to those low places that are so subject to floods as to be unfit for the finer grasses.‡ It has a powerful creeping root, and bears frequent mowing. It flowers as late as August.

* *Flora Londinensis*.

† Bath Agriculture, Vol. IX. 152.

‡ Curtis.

SECTION V.

Of the Necessity of obtaining select Seeds of the Plants recommended, with the Outlines of a Plan for raising them.

THE separate cultivation of the good grasses that are indigenous to our island, has been the great *desideratum* of the agriculturists, from the time that Stillingfleet first suggested this mode of improving our pastures to the present day. The difficulties attending this important innovation in husbandry have been various. The complicated species of that useful tribe of plants have not long been accurately distinguished. A long series of years employed by such an acute botanist as Mr. Curtis, hardly sufficed to do away the difficulties that occurred, in ascertaining their appropriate characters and qualities. However his unremitting attention to them, both in their natural and cultivated state, fully convinced him of their utility in agriculture.* He took every opportunity of impressing the public with a proper notion of their importance, and he pointed out those that he thought best calculated to constitute a good pasture. He urged the necessity of cultivating them separately for seed, and of compounding them for our pastures.

Still, however, notwithstanding his efforts and the exhortations of so many respectable men since the time of Stillingfleet, we are still to ask the question, "Where are such seeds to be obtained? This is the true reason why a system so plainly important to our agriculture has so long been confined within the shelves of our libraries, or to the partial efforts of some individual experimentalist.

In this state we may predict that it will continue to remain, till some plan can be put in execution for the supply of grass-seeds in quantities sufficiently large. Till the agriculturist has the means of proving the utility and practicability of the measure upon an extensive scale, it must be so limited as to be considered little better than a splendid theory.†

* Vide *Flora Londinensis*, and *Practical Observations on British Grasses*.

† To shew that it is not a mere theory, Mr. Kent tells us that he had seen a small spot of land, in the middle of a large piece, which had then been laid down twelve or thirteen years by Mr. Stillingfleet upon the estate of Mr. Price, of Foxley, in Herefordshire, with some choice seeds at the same time,

SECTION VI.

Of the different Soils.

THE plants intended by providence to constitute the principal food of cattle, are not confined within such narrow limits, as to render it necessary to enter into a nice discrimination of the infinite varieties of soil. The degrees of moisture or dryness, rather than the component materials of the land, seem to be the leading characters that should determine us in the choice of seeds for our future pasture.

I shall therefore divide the different soils into four classes; viz. 1. The upland. 2. The midland. 3. The low-land. 4. The fen. The first will include all dry soils, such as are fit for the growth of turnips.

The second will include such soils as are too retentive of moisture for the turnip husbandry.

The third will contain such sound lands as are occasionally overflowed by rivers or brooks.

The fourth will consist of fens, morasses, and peat bogs, which by draining are rendered capable of some degree of cultivation.

SECTION VII.

** Of Uplands, or such light Soils as are adapted to the Turnip Husbandry:*

As the cause of converting certain portions of our pasture into tillage, arises from the scarcity of wheat, and the object being to provide an adequate supply for the

when the remainder of the field was laid down with common seeds, and this spot was considerably better than the rest. It not only appeared so in his judgment, but was allowed to be so by Mr. Price's bailiff, who was well acquainted with the produce. Kent's Hints, p. 35. See also Martyn's Miller, article Grasses.

* These soils include all sands, sandy loams, and gravels, all calcareous loams, light dry stony soils, whether calcareous or not, and dry calcareous soils.

consumption of the kingdom, the leading consideration in the rotation of crops during the time the lands are in tillage, will be directed to that crop in particular. If the land (as is generally the case in old pastures) is replete with the food of vegetables, it will bear without assistance, a considerable succession of crops. For land of this sort in this condition I would recommend the following rotation.

First Shift.—1. Wheat,

2. Pease,

3. Wheat,

4. Fallow and turnips,*

5. Barley,

6. Clover,

7. Wheat,

8. Fallow and turnips thoroughly cleaned, manured with from 15 to 20 good cart loads of muck.

9. Barley with proper grass-seeds.

Second Shift.—Another good course for such sort of light lands broken up in a time of scarcity is the following :

1. Potatoes,

2. Wheat,

3. Fallow and turnips,†

4. Barley,

5. Clover,

6. Wheat,

7. Fallow and turnips manured as above.

8. Barley with proper grass-seeds.

Third Shift.—For lands not equal in condition to either of the above, the following course may suit.

1. Wheat,

2. Fallow and turnips,

3. Barley,

4. Clover,

* Some lands might bear this without assistance, I would rather recommend that muck should be used on the fallow.

† Should advise the fallow to be manured.

5. Wheat,
6. Fallow and turnips (well manured),
7. Barley, with proper grass-seeds.

Fourth Shift.—A fourth course for still weaker land would be,

1. Wheat,
2. Fallow well manured for turnips,
3. Barley,
4. Clover,
5. Wheat,
6. Fallow and turnips manured,
7. Barley with proper grass-seeds.

For the first, third, and fourth shifts, the field intended to be broken up, should be eaten bare till midsummer: when it should be ploughed so lightly as just to skim off the coat of turf. This should be dragged and harrowed in dry weather in order to kill the turf. It should be sown with wheat the beginning of October.*

Under the second course the land should be broken up before winter, and the ploughman by turning a round furrow should take care that the turf be covered. In the dry weather which frequently occurs in March, it should be cross ploughed, dragged, and harrowed, and the latter end of April or beginning of May, it should be set with potatoes in the usual manner with the plough.

The grasses suitable for sowing with the barley for laying down these lands to pasture again are the following, smooth-stalked poa, ray-grass, crested dog's tail, cock's-foot, dactylis, yellow oat, and sweet scented vernal-grass.

To these should be added a due proportion of marle grass, white clover, rib-grass, and yarrow, with sainfoin on its proper soil. I would recommend them to be sown in the following proportions per acre.

- Smooth stalked poa, 6 quarts.
- Ray-grass, 4 ditto.
- Crested Dog's-tail, 6 ditto.
- Yellow oat, 4 ditto.
- Cock's-foot dactylis, 2 ditto.
- Vernal-grass, 1 ditto.

* This is the manner in which in Norfolk they treat their "ollands," i. e. their *old lands*, signifying those lands which have lain in grass two or a greater number of years.

Marle-grass, 3 quarts.

White clover, 2 ditto.

Rib-grass, 2 ditto.

Yarrow, 2 ditto.

For good sandy loams two quarts of meadow fescue may be added.

On calcareous hilly soils, sainfoin should be substituted for the four last plants; and as the soil approaches a pure chalk, the sainfoin should be gradually encreased to the exclusion of the rest.

SECTION VIII.

Of Midlands, or such Soils as are too moist for the growth of Turnips.

THESE, as far as relates to the grasses with which they are to be laid down, should be divided into three classes, viz. 1st. The driest in point of soil and situation; such are those clayey loams that approach to the nature of turnip land. 2dly. Such as from their situation are drier, though the soil be retentive of moisture. 3dly. Those that from soil and situation, though sound, are of a moister nature.

The land intended to be broken up should be ploughed early in the spring, it should afterwards be cross ploughed, dragged, and harrowed, and in the beginning of October should be sown with wheat.

Soils of this sort in the best condition would probably afford the following course of crops:*

1. Wheat,
2. Beans well hoed,

* Mr. Marshall gives the following account of land of this description in the Vale of Gloucester.

"The crop of wheat from the newly broken land being reaped, and the stubble mown and raked off, the soil is turned over, and sown again (and perhaps a third time) with wheat at one ploughing! There have, I am told, been instances; there has (I think I am well informed) been one instance of wheat being thus repeatedly sown upon a piece of extraordinary good land, six years successively; the last crop being said to be nearly as good as the first!!! This, while it discovers the indiscretion of the farmer, evinces the natural strength of the vale land, and shews in a striking light the value of old pastured turf as a matrix for wheat."

Rur. Econ. of Gloucestershire.

3. Wheat,
4. Beans,
5. Wheat,
6. Fallow mucked, planted with cabbages, turnip-rooted cabbage,
or Swedish turnip transplanted in June,*
7. Oats,
8. Clover,
9. Wheat,
10. Fallow well mucked and planted,
11. Oats with proper grass-seeds.

Another course might be the following,

1. Wheat,
2. Beans well hoed,
3. Wheat,
4. Fallow mucked and planted,
5. Oats,
6. Clover,
7. Wheat,
8. Fallow mucked and planted,
9. Oats and proper grasses.

A third short course might be,

1. Wheat,
2. Beans (as before)
3. Wheat,
4. Fallow well mucked and planted,
5. Oats and proper grass-seeds.

The proper grasses for laying down the first or driest class of these lands would be as follows :

1. Meadow fescue, 8 quarts,
2. Smooth-stalked poa, 6 ditto.

* As these soils are too wet to feed off the fallow crops upon the land, and carting upon them often does much mischief, I have known a farmer use an ass and paniers with much success. With proper attention in this manner a considerable quantity (with the assistance of a boy or an aged man) may be brought to the stalls in a day.

3. Ray-grass, 4 quarts.
4. Crested dog's tail, 4 ditto.
5. Cock's-foot dactylis 2 ditto.
6. Vernal-grass, 1 ditto.
7. Marle-grass, 3 ditto.
8. White clover, 2 ditto.
9. Rib-grass, 4 ditto.
10. Yarrow, 2 ditto.

For the second class the following :

1. Meadow fescue, 6 quarts.
2. Meadow fox-tail, 4 ditto.
3. Smooth-stalked poa, 4 ditto.
4. Ray-grass, 2 ditto.
5. Crested dog's tail.
6. Cock's foot dactylis, 2 quarts.
7. Vernal-grass, 1 ditto.
8. Marle-grass, 3 ditto.
9. White clover, 2 ditto.
10. Rib-grass, 4 ditto.
11. Yarrow, 2 ditto.

For the third class,

1. Meadow fox tail, 6 quarts.
2. Rough-stalked poa, 6 ditto.
3. Meadow fescue, 6 ditto.
4. Smooth stalked poa, 4 ditto.
5. Ray-grass, 2 ditto.
6. Vernal-grass, 1 ditto.
7. Marle-grass, 3 ditto.
8. White clover, 2 ditto.
9. Rib-grass, 2 ditto.
10. Yarrow, 2 ditto.

It is impossible however to give general rules for every variety of soil and situation. A little practice will regulate the proper habitation of each plant. The farmer by cultivating them will know the meadow fox-tail, the meadow-fescue,

and the poas, as well as he now knows the ray-grass; and by observing where they grow naturally upon his land; will have a certain indication of the soil that is suited to them.

SECTION IX.

Of Lowlands, or Meadows.

THESE lands are occasionally overflowed by rivers or brooks. From these we derive our greatest crop of hay. Their natural moisture is propitious to the growth of our best grasses, and the sediment of the inundations operates as a constant manure. But the turf of these, as well as our other pastures, are filled with rubbish. If, therefore, it is intended to clean the meadow of its improper and noxious plants, the turf early in the spring should be lightly ploughed up, and afterwards cross ploughed and dragged and harrowed in dry weather, till the whole of the plants are killed, and till the ground be perfectly fine and level. With the first showers in August, it should be sown with the following grasses:

Meadow foxtail 2 pecks, vernal-grass, 1 quart
Meadow fescue, 2 ditto, white clover, 2 ditto.
Rough-stalked poa, 2 ditto, marie-grass, 2 ditto.
Ray-grass, 1 ditto, rib-grass, 2 ditto.

The foregoing mixture is adapted to the soundest meadow land, where the floods are soon drained off.

Where the water lies longer, the composition should be as follows:

Rough-stalked poa, 2 pecks.
Meadow foxtail, 2 ditto.
Meadow fescue, 2 ditto.
Flote foxtail, 4 quarts.
Flote fescue, 4 ditto.

And for situations still more wet, the following:

Rough-stalked poa, 2 pecks.
Meadow foxtail, 2 ditto.
Flote foxtail, 1 ditto.
Flote fescue, 1 ditto.

SECTION X.

Of Fens.

UNDER this head will be included such unsound lands as have, by a certain degree of draining become capable of some cultivation, whether they are properly fens, or morasses, or peat bogs.

In the first stage of the improvement of fenny lands and morasses, the water poa is the only plant proper to be cultivated. Its great utility in its spontaneous growth has been shewn in the description of it. I never heard of its having been cultivated from seed, but there is every reason to conclude, that, in situations resembling its native haunts, it might be introduced to much advantage. The land intended to be sowed with it should, in April, May, or June, as the weather may permit, be breast ploughed, and the turf burned. If the land under a favorable season will bear the plough, it should afterwards be ploughed and cross ploughed, well dragged and harrowed, and the seed sown in August, at the rate of two bushels per acre. Should the land not admit the plough, it would be better to breast plough and burn it in the middle of summer, to sow the seed in August, and to cover it as well as can in that case be done, by men drawing light harrows over it, and afterwards bush-harrowing it in the same manner. Upon land a degree more sound than the former, and subject to less violent inundations, the flote foxtail, and the flote fescue will be the proper plants.

The land should be prepared for them as before directed, and they should be sown in August, at the rate of one bushel of seed of each per acre.

On lands still more sound, approaching to the moister meadows, I would recommend the rough-stalked poa to be added, sowing equal proportions of each, at the rate, in the whole, of two bushels per acre. However, on lands like these, a still more eligible mode of cultivating the plants suited to them, would be to set the young plants themselves at the distance of about 8 inches from each other. The land should be prepared by breast ploughing, burning, &c. as before. The young plants having been raised from seed sown the preceding August, should be taken up, divided, and set at the distance before directed, as soon after the ground is prepared by the destruction of the weeds, &c. as the season will permit, taking care that the ground be sufficiently moist to ensure their growth. The first rains after midsummer

will probably afford an eligible opportunity. The distance between the plants will enable the hoe to be used to keep them free from weeds. This should be attended to the first autumn, and the following spring.* The process may be attended with some expence, but it would occur but once, and it would be creating a valuable pasture, probably for ages.

Peat bogs or mosses, in favourable situations, admit of very great improvement. These lands consisting almost entirely of decayed vegetable matter, require the aid of some alkaline substance to bring that matter into action. By the help of it, they are capable of being brought to a high state of fertility. When thoroughly drained, the first step should be to pare and burn the peat in considerable quantities, and it should be set with potatoes. This, after the draining, will give the land some time to settle. As soon as it will bear the team, if marle lie contiguous, the first opportunity should be taken of giving it a plentiful covering: with a light ploughing the ground should be sowed with oats and proper grass-seeds. The following winter, or early in the spring, a good top-dressing of marle should be applied to the turf: and thus lands of this nature may be turned into tolerable good pastures. If they could be irrigated, their value would be greatly increased, and if the water carried over them were impregnated with calcareous matter, they would become an artificial imitation of the famous Orcheston meadow, and rival it in produce. Next to marle, lime is the proper agent to resort to.† But I should recommend that this be always mixed with some sort of soil, in the proportion of about one-third lime to two-thirds soil. The best substance for this mixture is clay; but I would even use keen gravel rather than not mix it, as it would tend to give a firmness and soundness to the surface.

The different degrees of moisture should regulate the choice of the plants as before directed. Where the peat land is made thoroughly sound and marled, the plants recommended for meadows are proper to be cultivated thereon, in all cases adding a quart of the sweet scented vernal grass to the composition.

In moister situations, equal quantities of rough-stalked poa, floc foxtail, and floc fescue, with two quarts of vernal-grass, would be suitable; and in situations still more wet, a bushel of floc foxtail, and the like quantity of floc fescue, with two quarts of vernal-grass, would be the proper composition.

* I doubt not but this method might be extended with advantage to the sounder meadows.

† Where chalk is to be had it will answer every purpose of lime.

SECTION XI.

Of the Method of preparing the Land for the Grass-seeds, and of the Management of the new made Pasture.

The best pasture plants having for the most part fibrous roots, they feed near the surface of the ground. The great object, therefore, both of the preparative and subsequent management, should be directed to keep the manure as near as possible to the surface.

The ground, therefore, being perfectly clean by fallowing (without which no field should ever be laid down) upon land suited to turnips, the manure should be carefully spread, and very lightly covered by a shallow furrow, and the turnips sown thereon. In all cases of preparing for grass-seeds the turnips should be fed off with sheep upon the land; and as the sheep proceed in clearing the ground, it should be immediately ploughed with a light furrow; another ploughing will prepare it for barley and the seeds, and a good ploughman will in this turn bring up all the manure to the surface.

Upon lands of a moister nature, which are intended to be planted with cabbages, &c. the same care of keeping up the manure should be observed: but these will not admit of the green crop to be fed off: but when the cabbages, &c. are drawn off, the same process should be followed in the two ploughings for the oats and the grass-seeds, as is before directed. It seems almost unnecessary to add, that in all the ploughings and harrowings regard should be had to laying down the field as level as possible. In respect to sowing the grass-seeds, this should be done after the barley or the oats are harrowed in. Each sort should be sown separately, and the poa seeds, as before mentioned, should be carefully rubbed and divided in dry sand.* When this is done, the seeds should be covered by bushed harrows or hurdles, or by very light harrows, as the land may require. It should afterwards be rolled, and every clod reduced. Should this not be effected by the roller, people should be employed to break them with clod-beetles till the surface of the ground be even. When the Barley or oats are at a proper height, an opportunity for another rolling should be taken, and in this state it will remain till the harvest. After the corn is carried off,

* If most of the other seeds were well rubbed in sand they would be better separated when sown. *Vide antea, Poa pratensis.*

the field should be well fenced, and every sort of catle kept out. The infant plants not having yet got sufficient hold in the ground, would be plucked up by the roots, to the manifest injury of the future pasture.

In the first autumn, the weeders should go over it, and the like should be repeated in the spring, in each of which seasons it should be well rolled. Thus fenced and secured, it should be preserved till the following summer, when the crop may either be mowed for hay or kept for seed. The latter I should conceive would be the best method to pursue, as select grass-seeds would, for many years after the introduction of the system, sell at a great price. The seeds would be ripe early in July.* After the field is mowed, for still further precaution, I would advise the after-grass to be left untouched. Every farmer who can leave a field in this state must be sensible of its value in the following spring, as an early pasture for his milking cows, and ewes and lambs; a resource which should be found on every farm. However, should this plan not be adopted, and the field should be depastured in the autumn (which may be done with safety), I would recommend a dressing of compost to be put upon it in the winter, which, in the other case, must be deferred till the winter following.

When the compost is made of what is called maiden earth, the scourings of ditches, or other substances containing vegetable matter, one-third part of rotten fold yard muck will be sufficient.

For loamy or light soils, not calcareous, a mixture of equal quantities of marle and muck makes an excellent top dressing.

For all soils not calcareous, the cleansings of such highways as are repaired with lime-stone mixed with muck in the same proportion, forms a good composition: and for stiff and moist lands the cleansing of roads repaired with gravel, mixed in the same manner will prove highly beneficial. For calcareous soils, the compost first mentioned will be best adapted. All these before they are put upon the land should be well turned and blended together, so as to be spread equally upon the surface. About fifteen cart loads per acre will afford a good top dressing, which, repeated every fourth or fifth year, will keep the turf in good condition.

* What remains after the seed is got out would be good fodder for store cattle.

SECTION XII.

Of Draining.

As water springing from beneath the surface of the earth is noxious to all useful agricultural plants, a preliminary to every improvement is first to carry off that water by draining. This is equally necessary both in tillage and in pasture land. In respect to the different modes of draining, these are now too generally well known to require any thing to be said on that subject.

SECTION XIII.

Of Paring and Burning.

It will be seen from the preceding pages, that I have never recommended this to be done, but in the case of fens, morasses, and peat bogs. Those lands being in general replete with decayed vegetables, can bear a diminution. The vegetable matter may be spared, in order to produce an alkaline substance. In scarcely any other instances can this be done without injury. During the combustion, so much of the vegetable matter flies off, that the soil must ultimately be exhausted by it.* By the help of the alkali produced, what vegetable matter remains in the land may be brought into immediate action, and produce an abundant crop, which in certain weak lands would leave behind a *caput mortuum*.

I therefore think that combustion should never be made use of (except in the foregoing instances) when it can be avoided. Sometimes for the destruction of weeds it is unavoidable.

* I believe that what the modern chemists call carbon is the chief food of vegetables; and that an alkali of some sort or other is necessary to prepare it for their digestion. This interesting topic would require a separate disquisition. Let any agricultural chemist analyze his practice of manuring, and he will find most of its phenomena accounted for on this simple principle. Coal and charcoal, when properly applied, will hereafter probably be found to be excellent manure.

SECTION XIV.

Of Rent.

If the system herein detailed be founded in reason, and can be reduced to practice, it would no doubt follow that a considerable increase of rent could be afforded by the farmer who now occupies such pasture, and who should be permitted to bring the same into tillage. Those who know the value of ancient pasture as a matrix for corn, will readily see that in many cases profits equal almost to the value of the fee simple of the land would be derived under many of the courses of crops herein recommended. But those who know the cautious character of the farmer, and his great antipathy to what is new, will scarcely be sanguine enough to expect that where he has a lease, he will, for the sake of such permission, consent to any rise of rent at all. Some clear sighted men no doubt would seize the opportunity, and pay a handsome consideration; but I think the generality would not. In most cases, therefore, the permission must be held out as a *bounty* to encourage the undertaking, and be considered as a boon to promote the public good.* Where there is no lease of the lands, the landlord can make his own terms, and a short time will enable both himself and the tenant to fix upon an equitable equivalent. In all cases very strict covenants for a full adherence to the system would be requisite. To prevent fraud, the landlord should find the seeds, at the expence of the tenant,

Having thus, in a cursory manner, gone through most of the different topics pointed out by the Board; having endeavoured to shew that our population requires us to extend our tillage, and that our immediate resource lies in our pasture lands, which are capable of affording us plentiful supplies, and which may afterwards be returned to grass in an improved state, I shall conclude this hasty sketch.

* In walking over his lands with a sensible farmer, he shewed me an old piece of pasture, which he said was so full of rubbish that it was of little value. He had frequently lost cattle by turning them into it, yet he could on no account get permission to break it up. On examining it, I found it to be very foul, not one-third of the plants being eatable. I asked him, if it were broken up and laid down again with proper plants, could you afford to give more rent for it? Three times as much, was his reply.

Had the time been longer, or my avocations less pressing, I should have hoped to have furnished the Board with something more worthy of their notice.

If these loose hints throw a glimmering light upon the subject, which may lead to a further investigation of this important question, my object will be fully answered.

No. XXV.

An Essay on the best Means of converting certain Portions of Grass Lands into Tillage, and of returning the same to Grass, after a certain Period, in an improved state. By Mr. W. Stickney, Ridgmond, Holderness.

HAVING received an advertisement from the Board of Agriculture, wherein are offered premiums for approved essays "on the manner of converting certain portions of grass land into tillage without exhausting the soil, and of returning the same to grass after a certain period in an improved state, or at least without injury," and as I have no doubt but that the object is attainable upon all soils which it may be proper to convert into arable, I felt desirous of communicating to the Board my ideas upon the subject. There are, no doubt, certain portions of grass land which ought always to be kept in grass; for instance, rich, light, sandy loam, capable of feeding oxen. If such soils are broke up to arable, they are so abundantly productive in straw that the crops generally become lodged, grown over with weeds, and are of course much less productive in grain than soils not so rich; and although by a succession of exhausting crops it might be so reduced as to be sufficiently productive in grain, yet, by that means, the vegetative principle of the soil would be so far lessened as that when laid down to grass it would not be near so productive as before it was broke up. Therefore it is my judgment that soils of this description ought to be kept in grass. But upon almost all poor soils, and soils suitable for, and not too rich for the production of grain, the grand object of the Board may, I believe, be attained by a proper mode of breaking up from old sward, succeeded by such a system of cropping as will rather enrich than exhaust the soil.

My practice is, upon a considerable farm, the soil of which consists of clay in many of its varieties, but most generally a clayey loam of a moderate degree of richness, but very unproductive in old sward until broken up, in some parts partaking of a gravel, and in some others of a slight degree of sand. The two latter are good turnip land, but the principal part of the farm is a closeish textured clayey loam, in others a looser clay loam. I have also a considerable quantity of low lands, which is somewhat of the nature of the fens, the soil in some degree a vegetable loam, with

a clayey subsoil. Upon all the soils above enumerated, and indeed in general, except where the sward is very smooth and fine, and except where sand is very predominant, or where there is so much gravel and stones as to obstruct the progress of the paring spade, I would recommend paring and burning when first broke up from old sward. There are two reasons which principally operate with me in favour of sod burning. The first is; as all old sward is infected with a variety of insects, particularly the grub of the *tipula*, which greatly endanger the first erop (provided it be not pared and burnt, and that the erop be grain), which by sod burning is in a great measure prevented, for by the paring and the burning a considerable number of those insects are destroyed, and many more are exposed and devoured by a variety of birds, for which they are food, so that their numbers become greatly reduced; and, as I would almost invariably after sod burning sow turnips or rape to eat off with sheep, or, in a few instances, rape to remain for seed, the few insects which are left, particularly the grub of the *tipula* (which does more damage than all others beside), become generally inactive by the time those plants are vegetating, being then in the *aurelia* and fly state, in which states they eat nothing.

My second reason in favour of sod burning is, the quickly reducing of the sward, which, upon strong soils particularly, is injurious to several crops, to a useful and enriching manure.

I know of no better method of performing the operation than that described by Mr. Marshall in his Rural Economy of Yorkshire, Vol. I. page 304, care being taken to reduce the turf completely to ashes without its undergoing too great a degree of heat, so as to prevent the ashes from becoming red, which if they do they lose a great part of their virtue as a manure; the heaps must not be made too large, and should be frequently examined during the time of burning, and kept from getting too hot by scraping out the ashes with an instrument for that purpose.

The two following systems of cropping will be found of advantage upon moist soils of a closeish texture. I am no friend to a precise regular succession of crops; the general principal which I would recommend is, to avoid at all times two or more exhausting crops immediately following each other; and I believe that the greater variety of crops properly introduced, the greater will be the produce of a given quantity of land, with a limited quantity of manure. I do not take upon me to assert that any of the following rotations of crops have been precisely such as I have adopted, although my practice upon the different soils comes pretty near it, and I

think I clearly understand the general effect of each crop upon the soils alluded to; but as we have such a variety of seasons in this climate, it is necessary that the agriculturist should vary his crops and his operations according to the state and situation his land may be put into from unexpected events.

After paring and burning, plough thin, and sow,

No. 1.

1. Turnips or rape,
2. Oats,
3. Beans or clover,
4. Wheat,
5. Turnips or fallow manured,
6. Oats,
7. Clover,
8. Wheat,
9. Turnips or fallow, limed with some manure,
10. Oats,
11. Grass ley,
12. Ditto,
13. Ditto,
14. Wheat or oats,
15. Beans,
16. Wheat,
17. Turnips or fallow, limed with some manure,
18. Oats, or perhaps in some instances beans,
19. Turnips manured,
20. Oats sown thin, and with a suitable mixture of seeds for a perennial ley.

No. 2.

1. Turnips or rape
2. Oats,
3. Beans or clover,
4. Wheat: if the land be very poor, turnips, oats, turnips, clover, wheat, and then the same as after the fourth year,

3 N 2

5. Turnips or fallow manured,
6. Oats,
7. Grass ley,
8. Ditto,
9. Ditto,
10. Wheat or oats,
11. Turnips, limed with some manure,
12. Oats sown thin, and with a proper mixture of grass-seeds for a perennial ley.

No. 3 and 4 are intended for lighter soils

No. 3.

1. Turnips,
2. Barley or oats,
3. Clover,
4. Wheat,
5. Turnips limed and manured,
6. Barley or oats,
7. Grass ley,
8. Ditto,
9. Ditto,
10. Wheat,
11. Beans or peas,
12. Wheat,
13. Turnips manured,
14. Barley or oats,
15. Clover,
16. Wheat, or in some instances beans,
17. Turnips limed and manured,
18. Barley or oats sown thin, and with grass-seeds for a perennial ley.

No. 4.

1. Turnips,
2. Barley or oats,
3. Clover,

4. Wheat: if the land be poor, turnips, barley or oats; turnips, clover, wheat, and the same as after the fourth year,
5. Turnips, manured,
6. Barley or oats,
7. Grass ley,
8. Ditto,
9. Ditto,
10. Wheat,
11. Beans or peas,
12. Wheat,
13. Turnips, limed and manured,
14. Barley or oats sown thin, and with grass-seeds, for a perennial ley.

No. 5.

1. Rape,
2. Oats or wheat,
3. Beans,
4. Wheat,
5. Rape, limed only,
6. Oats or wheat,
7. Beans,
8. Wheat,
9. Rape, limed and manured,
10. Oats sown thin, and with grass-seeds, for a perennial ley.

In the first breaking up of old sward, if the bottom be rough and coarse, after paring and burning I would recommend rape for seed, being more certain than any other crop. The straw reduced to a proper manure by littering with it the straw yards, &c. After the rape, give the land two or three ploughings in the same summer, which will greatly aid to the preparation for turnips the next season, as an introduction to the system above. And it may also sometimes happen, in the first crop, upon strong land, that the season may prove too dry for the growth of turnips or rape to eat off with sheep, it being a more hazardous preparation for them than any other; it may, in that case, also be sown with rape for seed, as it is not necessary to sow it until a month or six weeks after the time requisite when intended to be eaten off with sheep.

The rotation, No. 1, is adapted to closeish-textured clay loams, upon which I would never fallow but when necessity points out the propriety of it, which will sometimes be the case, as when by a failure of crops the land may have become foul, or when by an unfavourableness of seasons it cannot be sufficiently cleaned for turnips, &c. Instead of turnips or rape, a part may be planted with cabbages or potatoes, as circumstances may point out. Should the land be very strong, it would be advisable instead of turnips to sow rape to eat of early in the autumn, when it may be sown with wheat if the season prove favourable, or left for oats in the spring, after which clover, &c.

Upon all strong lands it is necessary when rape or turnips are fed off in the winter, to plough as the land becomes cleared, in order that it may get pulverised and meliorated by the frosts, which will greatly facilitate the working of it in the spring; whereas, if left unploughed until dry weather sets in, it will be almost impossible either to plough or harrow it; and it is also a great advantage when land of this description is intended for turnips or rape, to plough two or three times in the autumn immediately after harvest, if an opportunity offer, as it would lessen very much the labour of the next spring. But, at all events, if not ploughed in the autumn, it should be done early in the winter. If intended for a fallow, winter vetches and rye might be sown for spring feed. Turnips and rape are not to be depended upon without manure. Lime I find very favourable for the production of grass, but I would in every instance have it intimately mixed with the soil whilst in a state of arable, and not put upon the grass after it is laid down. Beans to be dibbled, or drilled, and horse hoed, and if well managed I know of no better preparation for a wheat crop than bean stubble. The clover to be mown once.

From what I find in my own practice, and from what I have observed in the practice of others, I am of opinion that a crop of turnips, or rape, well managed, where the land has been properly cleaned and manured, and the turnips or rape fed off with sheep, adds as much fertility to the soil, as three exhausting crops will deprive it of. Beans and clover I consider as neutral, but if manured to add one year each. The temporary ley of grass, which may be continued two or three years at pleasure, to be grazed with sheep whilst soft in the spring, and after it becomes firm with the same or any other stock during the summer: this I conceive will add two years to the fertility. No. 1, is under a supposition of the land being kept in arable 20 years, which, according to my idea, will be improved eight, there being

five crops of turnips, rape, or fallow, which suppose upon an average add three years each to the fertility, will be

Grass ley for two or three years - - - 15

Three crops of beans and clover, neutral, - - - 2

17

Nine crops of wheat and oats to deduct one each - 9

Improved - - - 8 years.

No 2 is for the same kind of soil as No. 1, but under a supposition of its being kept but twelve years in arable; there are three crops of turnips, rape, &c. which at three years each add to the fertility

Grass ley - - - 9

Beans or clover 1, neutral, - - - 2

11

Five crops of oats and wheat to deduct - - 5

Improved - - - 6 years.

Nos. 3 and 4 are intended for lighter soils, good turnip land; No. 3, under a supposition of its being kept 18 years in arable; and No. 4, fourteen years; on those soils, I believe fallows need never be introduced. In No. 3, the improvement will be six, and in No. 4, five years, according to the foregoing calculation.

No. 5, is intended for low lands, in some degree a vegetable loam, under a supposition of its being free from floods, and well drained. I find lime to be of very great use to land of this description, both in the production of grain and grass. It might be sown down with suitable grass-seeds with oats in the tenth year, or sooner, with clover, &c. for a temporary ley of two or three years, after which it may be broke up and sown with oats the first crop, and then rape, and so continued in the rotation as above at pleasure. Rape upon this kind of land generally grows to a large size; it should be eaten off pretty early in the season. Paring and burning is here essential to good management when first broke up; according to the above, the improvement in ten years will be four.

From what I have said above, I would not have it inferred that I am of opinion

that turnips or rape fed off with sheep, or a well managed fallow, add three years each to the improvement for an unlimited number of years; because I think after it has been so cropped for a few times it may decrease to a certain *ratio*, so as that, at the end of twenty years the improvement may be only four, or five, or six, but that it will be considerable I have no doubt; and I have no idea of land being tired, worn out, or exhausted, under a system of arable similar to the above but that it might be kept in a state of culture without exhaustion for any number of years; and land which has been under an exhausting system and greatly reduced, may be renewed by introducing it into any of the above rotations of cropping, as the nature of the soil may point out, having experienced such to be the effect in my practice.

Grass land when first broke up, if rape or turnips on stiff soils, should be ploughed but once and thin, but upon light soils I think two or three ploughings, and at a medium depth, would be better, so as to mix the ashes and soil well together.

Turnips and rape ought to be fed on the land, and with sheep only, except upon very light soils, where calves may be admitted, but sheep are the only stock which I would recommend to come upon the land. When they are wanted for other cattle, some of the largest may be picked out and carted off from light soils, and given to them in fold yards, or under sheds, but in no case should they be carted from strong land, as the treading of cattle and carriages would do a great deal of damage.

Upon stiffish land, grass-seeds, in my opinion, ought to be sown with oats, but upon light soils I am not decided in my judgment whether oats or barley are preferable; but in either case the oats or barley should be sown very thin, because it is then of more importance to have the land well covered with grasses, than to have a large crop of grain; and should it become lodged, or so luxuriant as to endanger the fate of the grasses, I think it would be better to cut it up in any state of its growth than to risk the fate of the new sward. A thin crop of corn shades the young grasses, and prevents the drought from operating too much upon them.

As to the sorts and quantities of grass-seeds for each kind of soil, I may observe that, when intended for a temporary ley of two or three years, about 7lbs. of white clover, 5lbs. of red, and 5lbs. of trefoil, with about 2 pecks of ray-grass per acre will be found a very good seeding; the ray-grass and red clover push early in the spring at a time when herbage is much wanting, and after it slackens in its growth, the white clover and trefoil keep up the nutritious bite. But when laid down to a

perennial ley, it is particularly desirable to have such a selection of Grasses as will make the most profitable and durable sward, which is a point I have never yet attained to my own satisfaction. I will mention the general practice, the disadvantages attending it, with my ideas of improvement. The common method is to sow about 8 or 9 lbs. of white clover, 5 or 6 lbs of trefoil, sometimes a few lbs. of red clover, about half a bushel of ray-grass, and 5 or 6 bushels of hay-seeds per acre; the hay-seeds are a miscellaneous mixture of valuable and noxious plants, sometimes all kinds grow promiscuously, and at other times very little of any kind, owing to the vegetation principle being destroyed by heating in the stack, so that there is no certainty by this means of obtaining a good sward. My idea of improvement is to select the most valuable kinds of grasses, to cultivate them separately, as ray-grass, rib-grass, clover, &c. now are: and the judicious farmer, by seeing the different kinds, and their manner of growing, will readily proportion them as to kinds and quantities, by which means I have little doubt but he will obtain a valuable sward, continued from the earliest to the latest season of vegetation. Having lately understood that the Board of Agriculture has recommended a selection of some of the most valuable kinds of grasses, and that they are now to be obtained separately in London, I am at present preparing a piece of ground, in order to raise the kinds separately, and try experiments thereon.

For the first two or three years after laying down, the grass ought not on any account to be mown; for one crop of hay, by permitting the strong plants to grow up, and thereby smothering or checking the smaller kinds, and many of them by maturing their seed exhausting themselves of their own strength, would be doing a great injury for years to come. Pasturing close with sheep from the early shoot in the spring, and with the same or heavier stock when the land becomes firm enough to bear them, during the first two or three years, appears to me, from my own observation and experience, essential to good management.

With respect to manure, I think it is better to mix it with the soil whilst in a state of arable, than to spread it upon the surface when laid down to grass; yet there is no doubt, but that a covering of manure would for a few years add greatly to the fertility, but I would rather deprive it of manure whilst in grass, than at all pinch it in a state of arable, believing the fertility of the latter to be much more permanent.

By the mode of management above recommended, I have no doubt but such land as there alluded to, will produce, while in a state of culture, more useful food

cattle than it did previous to its being broken up, and when laid down to grass, be found in a considerable state.

When lands have an absorbent subsoil, underdraining is unnecessary, but where the subsoil is retentive, underdraining is mostly of great use; and where there is an ousing of water to the surface, it is essential to good management. If after a complete surface draining rushes continue to grow, this is a certain criterion that underdraining is necessary.

No. XXVI.

*An Essay on the best Means of converting Grass Lands into Tillage, without exhausting the Soil, and of returning the same to Grass in an improved State.
By Mr. John Tuke, of Lingcroft, York.*

THE improvement of old coarse sward land, by ploughing for a few years and afterwards laying down again to grass, was well known to that excellent agriculturist Walter Blythe, so early as the middle of the seventeenth century, and it is equally so at this time, to those who are grateful enough to make a generous return for its favours; but it is too often the case, that the avarice of the farmer induces him to crop the land, so long as it will produce sufficient to pay for labour; the land is then so exhausted, as to require many years and much expence in manure to restore it: hence arises the general antipathy of landlords to their tenants' ploughing out such lands, and not without sufficient reason; but that it may be done to the improvement of the land, as well as to the profit of the occupier, I am certain, if a plan similar to the following be observed.

When the land is wet and spongy, it should, in the first instance, be effectually drained, otherwise the lime or manure, which in future may be laid upon it, will in a great measure lose their effect, the produce will be little but weeds, the corn will always be light, and no permanent improvement can ever take place.

Clays of any kind (except poor, thin, cold-soiled ones), strong loams, black moory peat, the sward of any of which is thick and coarse, covered with moss or rushes, it is always best to pare and burn, which at once destroys the texture of the sod and makes the land easy to work; this operation is performed in the following manner.

The labourer being provided with a proper instrument called a paring spade, he thrusts this forward under the sod with his thighs, by the exertion of his loins, which cuts the sods about one foot in breadth, and by raising the right side of his spade, he turns them off with the grass side downwards, of any length he pleases, which is usually about three feet, and generally as thin as the nature of the turf will allow; but if the surface is very coarse and rough, and there is a good depth of soil, it

admits and requires a thicker sod, than if the herbage be fine; so that the thickness of the sod will vary from one, to two inches. If the weather be dry, they will be fit to burn in a week or two, by laying as the spade, leaves them with the roots exposed to the sun and winds; but if the weather be wet, it is necessary to employ women or children to set them up on edge, to expedite their drying; after which they are put into heaps of the size of a small haycock, care being taken to lay them light and open within, but to keep them close covered on the outside during their burning to prevent too rapid combustion, which would destroy the fertilising quality of the ashes.

If the sods are not required to be set on edge to dry, the operation may be done for about one guinea per acre.

There is not a doubt, but that paring and burning renders the land extremely fruitful for a time; but if it is not supported by adventitious aids, and indulged by suitable cropping, it becomes more completely exhausted than by any other mode of cultivation; it is therefore necessary, before that fertility is exhausted, to apply it to the production of such crops, as will restore that which has been spent in the production of corn or other exhausting crops; for which purpose I recommend the following mode of cultivation and courses of crops for the better kinds of clay or strong loam.

Let the paring and burning be done as early in the spring, as the weather will permit, and in order to reap the utmost benefit from the ashes, the sods before they are burnt should be removed from the ridges of the lands to the sides, leaving a bare space of about five feet wide, which should be ploughed to the depth of six inches: the sods may then be made into heaps on the ploughed parts, and whilst burning, the sides may be ploughed, after which the ashes may be spread on the top of the furrow: by this process, the ashes get minutely mixed with the soil, and within reach of the roots of the crop sown thereon. It is common to burn and spread the ashes before the land is ploughed; by so doing, the ashes lie beneath the furrow, and are therefore, in a great measure, lost to the first crop, and a great part of the salts contained in the ashes is washed away before another crop succeeds, which inconvenience is prevented by adopting the mode above recommended.

I have had some practice in paring and burning, and my employment has afforded me frequent opportunities of observing the process and effect thereof. I have always found, that upon the soils before-mentioned, it is the best way of breaking

up old grass land, and if a proper treatment of the land be observed, there is an evident superiority in its favour when the land is returned again to grass, to that which has been broken up by ploughing only. I once saw a field of strong clay land, which had been twenty years laid to grass, after having been a few years under the plough, the coarsest part of it was broken up by paring and burning, and the finer part of it by ploughing only, and notwithstanding it was at that distance of time after, there was a very striking difference in favour of the paring and burning.

The course of crops I have adopted, after paring and burning a rather loamy moist soil, has been, 1. Rape sown in the beginning of June, and eaten off with sheep in time to sow 2. Wheat for the second crop. 3. Turnips, drawn off in time to sow wheat for the 4th crop, which crop is now growing, and I intend to sow grass-seeds amongst the wheat in spring. The rape was sown with no other manure than the ashes, but for the turnip crop about sixteen tons of strong town manure, and four chaldrons (thirty-two bushels each) of lime was laid on; the crop was a remarkably good one. This course I adopted as not being exhausting to the soil, and wanting to have it again in grass as soon as I could; but there are other courses of crops which may be adopted with more profit, and with no more injury to the soil; those I recommend for clays or strong loams, are

1. Oats,
2. Rape for a green crop,
3. Wheat,
4. Beans or peas hoed,
5. Rape for a green crop,
6. Oats or barley, with which crop the grass-seeds should

be sown. As lime always answers incomparably well while the ashes are fresh, and by its action, as a septic, prepares the roots of the sward which lie below the paring spade for food for future vegetation, it should always be used plentifully in the fore part of the course, and therefore there should be not less than six chaldrons per acre laid on for the first green crop of rape, which crop should be eaten upon the land with sheep: for the next green crop of rape, the land should be well manured with dung, or some other rich oleaginous manure, which the ashes and lime before deposited in the soil will improve for the nutriment of succeeding crops. If the soil is not unsuitable for barley, I recommend that crop from my own

experience, in preference to oats to sow the grass-seeds with, having always had the seeds thicker set and better grown amongst the former than the latter.

The kinds and quantity of grass-seeds per acre necessary to be sown on strong land, are of white clover 10lbs. cow-grass 6lbs. trefoil 6lbs. rib-grass 4lbs. rye-grass one bushel, and of good hay-seeds, if they can be got, four bushels.

Or the following course of crops may be used,

1. Rape for seed,
2. Wheat,
3. Rape for a green crop,
4. Barley or oats, then grass; or instead of grass, the course may be extended by
5. Red clover, sown amongst the barley or oats,
6. Wheat,
7. Rape,
8. Barley or oats, with which crop grass-seeds should be

sown. In this course the land, after it has been pared, burnt, and once ploughed, should be limed with six chaldrons of lime per acre, and have one or two more ploughings, and be well harrowed before the rape seed is sown; for the green crop of rape the land should be well manured with dung, and the crop eaten off with sheep.

Upon strong soils, of less fertility than the foregoing, the following courses are excellent,

1. Rape for a green crop,
2. Oats,
3. Rape for a green crop,
4. Wheat,
5. and 6. Grass,
7. Wheat sown on one ploughing,
8. Green crop of rape,
9. Oats or barley, then grass for five or six years; or,

instead of grass the fifth and sixth years of the course, beans or peas the fifth; sixth, grass-seeds sown without a crop of corn to lie five or six years. In these courses the land should be limed for the second crop of rape, with six chaldrons per acre, and both crops of rape should be eaten with sheep; the grass-seeds should

be sown amongst the wheat in spring, and the grass should be manured in the spring of the latter year: if the last course is preferred, the land should be winter ploughed for the bean crop, and early in spring should be well manured with dung, and the beans should be sown in drills and clean hoed; after the land is cleared of the crop, it should be winter ploughed, and have another ploughing early in the spring; after this it should be repeatedly harrowed, at proper intervals, to destroy all the weeds which may appear, and to make the surface as even as possible. In April, take an opportunity, in showery weather, to sow two pecks of rye and one bushel of tares, which should be harrowed in, then sow the grass-seeds, and either brush them in with thorns, or roll them in with a light roller.

The grass-seeds, by being sown in this manner, are deposited in the ground of nearly an equal depth, without any of them being over deep, they of course come up evenly, and by the land having been kept clear of weeds the preceding year, and those which have grown in spring being thoroughly destroyed, they will not be incommoded by them; when they are sown on land newly ploughed and harrowed in, many of the seeds are buried too deep, and consequently never come up, and the seeds of weeds fresh turned up by the plough, vegetate to the great injury of the young grass.

When the rye and tares are grown to be about three or four inches long, turn in a moderate stock of sheep, which keep increasing as the pasture increases, taking care not to eat it down close, but to keep a good cover; by this means an immense stock of sheep, in proportion to the quantity of land, will be kept, and the young grasses will be sheltered by the rye and tares from the scorching rays of the sun, while the sheep are dropping a large quantity of manure to the enrichment of the land. This mode, and others nearly similar, I have practised several times, and always found it to answer incomparably well.

The best course for a blacky moory sand is

1. Rape or turnips,
2. Oats,
3. Turnips,

4. Rye, then grass for four or five years. For the first crop of rape or turnips, the land should be limed after the rate of four chaldrons per acre, and harrowed in with the ashes; the second crop of turnips should be manured for, and both crops should be eaten upon the land with sheep; the grass-

seeds should be sown in the spring amongst the rye; these should consist of 10lbs. of white clover, 10lbs. of trefoil, 4 lbs. of rib-grass, and one bushel of rye-grass.

For peat land no better course can be used, than

1. Rape,
2. Oats,
3. Rape,
4. Oats and grass-seeds; for the latter crop of rape, not

less than six ealdrons of lime per acre should be spread upon the land, and both crops should be eaten off with sheep; the grass-seeds should consist of one bushel of rye-grass, 14 lbs. of white clover, and 8 lbs. of rib-grass; these should be sown in spring with the last crop of oats.

In each case the land should continue four, five, or six years in grass, when it may be again ploughed out, and clay or strong loams may then be properly cropped in the following courses,

1. Oats,
2. Rape for a green crop,
3. Wheat, then grass to continue four or five years. The

green crop should be well limed and manured for, and eaten upon the land with sheep. Or for rich strong loam, the following is good second course,

1. Turnips on once ploughing,
2. Barley or oats,
3. Clover,
4. Wheat,
5. A green crop of rape to be eaten with sheep,
6. Barley, then grass.

In breaking up the land for this course, it should be deep and well ploughed in January or February; if grass should grow in the seams in spring, some sheep should be turned in to eat it; in May it should be manured with short manure and afterwards well harrowed, and in showery weather in June the turnip seed should be sown and harrowed in; in this manner I have seen excellent crops of turnips obtained, and they may be thus grown and fed off, on soils not suitable for them by any other mode of cultivation; the sod gives a firmness to the soil which supports the tread of the sheep, and there is always a mellowness acquired by land being well laid a few years to grass, which makes it approximate nearer to a turnip soil.

For the first barley crop, the land should be twice ploughed, the clover crop should be manured, and for the green fallow of rape, the land should be limed with not less than five chaldrons per acre: the grass-seeds should consist of the same kinds and in the same proportion, as before-mentioned, for this kind of land.

Breaking up grass land without paring and burning, is applicable to all dry, sandy, gravelly, and chalky soils, also light loams and cold thin clays. The courses which I have practised, and found to answer best on all those soils, except the last, are

1. Oats,
2. Turnips,
3. Barley, then grass.

Or,

1. Rye,
2. Turnips,
3. Barley, then grass;

Or if the soil consists of a rich light loam or good gravel, the last course may be continued by

4. Red clover or tares,
5. Rye or wheat,
6. Turnips,
7. Barley, and then grass.

Each of these courses, when the turnip crops are well manured for, and clean hoed, leave the land in fine order to be laid down again to grass.

The grass-seeds should consist of 12lbs. of white clover, 12lbs. of trefoil, and one bushel of rye-grass per acre.

Cold thin clay soil is never kept long in tillage with profit, and therefore should not be ploughed out of grass until it is become unproductive. When it is old sward, it is best to plough about five inches deep for oats, and those should be of a hardy kind, such as Tartarian or Scotch oats: immediately after the ground is cleared of the crop, cross-plough and grip it; early in spring, harrow it well, and manure it with ten loads of good manure, then plough, harrow, and drill it with beans, which should be kept clean hoed, and immediately after harvest plough up the land, and lay it perfectly dry, by water furrowing and gripping; in spring, plough twice and harrow well, then sow the grass-seeds, and treat them in the same manner as before recommended to be sown without a crop of corn. The grass-seeds should

consist of 12lbs. of white clover, 8lbs. of trefoil, 8lbs. of cow-grass or red clover, and one bushel of rye grass.

This kind of land thus sown will bear to lie about four or five years, when it should be again broke out, and sown with wheat on once ploughing, next beans, then grass-seeds, as above.

On breaking out grass lands, it is best to plough a good depth, where the soil will allow of it, as by that means the quantity of vegetative soil is increased; I therefore recommend that all soils, except very thin ones, be ploughed at least six inches deep; this will afford a sufficient quantity of earth to cover the seed which may be sown thereon.

As general observations on laying down every kind of soil to grass, particular attention should be paid to have the surface as even as possible, before the grass-seeds are sown, and if that is done early in the spring, rolling them in will be sufficient, and in any case brushing them in with thorns, is preferable to harrowing.

Young sward is much thickened and improved by being pastured the first two years, and during the first winter and summer it should not be close eaten, and in that time the stock should consist principally of sheep.

If the land has been treated, as above directed, the grass will require no manure for the first two or three years.

On permission being given to a tenant, restricted by his lease or agreement to plough up grass land, he may afford to pay an advance of rent, as appears by the following statement for one acre.

I will suppose the soil to be clay or strong loam in old sward, and that the rent is 15s. per acre, and cropped in the course first recommended.

Dr.	First year.	Cr.
Paring, burning, and spreading the	£. s. d.	
ashes - - -	1 10 0	
Ploughing - - -	0 7 0	
6 Bushels of seed oats - -	1 10 0	
Sowing - - -	0 2 0	
Harrowing seven times - -	0 7 0	
Reaping - - -	0 7 0	
	£. 4 3 0	

Dr.	£. s. d.	Cr.
Brought over	- - - 4 3 0	
Carting home, thrashing, and taking to market, 5 qrs. $4\frac{1}{5}$ bushels	0 10 0	
Tithe	- - - 1 1 0	By 6 qrs. of oats at 30s. 9 0 0
Profit	- - - 4 16 0	By straw - - - 1 10 0
	<u>£. 10 10 0</u>	<u>£. 10 10 0</u>

Second crop.

To 4 ploughings	- - - 1 0 0	
To 10 harrowings	- - - 0 10 0	
To raking up or gathering the quicks	0 4 0	
To 6 chaldrons of lime at 12s.	3 12 0	
To spreading ditto	- - - 0 3 0	
To rape-seed	- - - 0 1 0	By a green crop of rape 3 0 0
To tithe	- - - 0 6 0	By loss - - - 2 16 0
	<u>£. 5 16 0</u>	<u>£. 5 16 0</u>

Third crop.

To ploughing	- - - 0 6 0	
To 2 bushels seed wheat	- 1 0 0	
To sowing	- - - 0 2 0	
To harrowing	- - - 0 3 0	
To weeding in spring	- - - 0 3 0	
To reaping	- - - 0 8 0	
To tithe	- - - 1 8 0	
To carting home from the field, thrashing, and taking to market, 2 qrs. $5\frac{1}{5}$ bushels at 4s.	0 10 9 $\frac{1}{2}$	By 3 qrs. of wheat 12 0 0
To profit	- - - 9 19 2 $\frac{1}{2}$	By straw - - - 2 0 0
	<u>£. 14 0 0</u>	<u>£. 14 0 0</u>
	3 P 2	

Dr.	Fourth crop.	Cr.
	£. s. d.	
To 2 ploughings - -	0 11 0	
To harrowing - -	0 3 0	
To 2 bushels of seed beans -	0 10 0	
To drilling and horse-hoeing -	0 7 0	
To tithe - - -	0 15 0	
To reaping - - -	0 5 0	
To carting home, thrashing, and taking to market - -	0 11 0	By 3 qrs. of beans
To profit - - -	4 8 0	By straw -
	<u>£. 7 10 0</u>	<u>£. 7 10 0</u>

Fifth crop.	
To 3 ploughings - -	0 15 0
To 10 harrowings - -	0 10 0
To 10 loads of manure spread upon the land - - -	5 0 0
To rape seed - - -	0 1 0
To tithe - - -	0 7 0
	<u>£. 6 13 0</u>
By green crop of rape	3 10 0
By loss - - -	<u>3 3 0</u>
	<u>£. 6 13 0</u>

Sixth crop.	
To 2 ploughings - -	0 11 0
To 4 harrowings - -	0 4 0
To 6 bushels of seed oats	1 10 0
To sowing - - -	0 2 0
To reaping - - -	0 7 0
To tithe - - -	1 12 0
	<u>£. 4 6 0</u>

When the land is well laid down, as before directed, it will in that state continue to be worth the advance, until it requires ploughing out again.

It is to the interest of tenants to sow proper quantities of grass-seeds of the best quality, but we frequently see, that either from poverty or avarice, there is neither a sufficient quantity nor that of the best quality sown; it is therefore safest in those cases for the landlord to procure the seeds himself, for although to a tenant in whom he has a sufficient confidence it may be safely left, yet, as a general rule, I cannot recommend it.

No. XXVII.

An Essay on the best Means of converting Grass Land to Tillage, and of returning the same to Grass, after a certain Period, in an improved State, or at least without Injury. By Henry Protheroe, Esq. Henley near Bristol.

If the strength of a nation be constituted by the number of its inhabitants, and its power increased in proportion to the extent of its population, a wise government will ever regard the prosperity of its agriculture. The increased produce of land, when converted to a state of tillage, and the increased number of persons to whom it gives employment and sustenance, are objects in their nature and effect, of infinite importance.

Of late years the quantity of corn produced in this kingdom, has not been equal to the consumption of its inhabitants. We have been dependent on foreign nations for a very large supply. Our deficiency at home may have been produced in part by many concurrent causes: an increased population, increased luxury, the war, short crops, and the extraordinary consumption of the distilleries, are the most ostensible.

The Board of Agriculture has taken wise and certain means to secure abundance in future years; unfavourable seasons may again arise, but scanty crops will seldom be complained of, and scarcity never felt, when our farmers know, and practice “the best means of converting a portion of their grass lands into tillage, and of returning the same to grass, after a certain period, in an improved state, or without injury.”

The writer of the following sheets is aware, that a subject so important must call forth the exertions of men, whose talents and means of information are far more extensive than those which he possesses; yet the acquirements of agricultural knowledge having long formed the principal object of his pursuit, he ventures to submit the result of his experience and information to the Board of Agriculture, in the humble hope, that it may in some small degree support their salutary, and beneficial views.

When grass land is converted to tillage, after a certain period to be returned to

grass, the quality of the soil, the crops that it is best calculated to produce, and the cultivation of these crops in such succession, that the land shall be impoverished in the smallest degree, in proportion to the value of its produce, are objects that should principally engage our regard. Let the farmer despair of success, if instead of attending to these points, shackled by the prejudices of his forefathers, and blindly attached to their customs, as having the sanction of antiquity, he pursues modes of cultivation, which ignorance alone could dictate, and prejudice alone attempt to justify.

Soils.

The different qualities of soil are frequently so mixed and blended together, that without recourse to chemical analysis, it is difficult to ascertain which predominates. The many varieties of mixed soils, which this combination affords, are distinguished in different districts, by different names. In order to avoid provincialisms, I shall comprise every variety, with which I am acquainted, under the four general heads of *sand, clay, loam, and chalk*, describing such a system of management in the tillage, and mode of restoring each to grass, as I conceive will contribute most to the fertility of the soil, and to the profit of the farmer. I ought, however, to premise, that my own practice has never extended to chalk soils. Any remarks therefore that may appear on their cultivation, will arise from the observations I have made on the practice of others, or from information, that I know to be well authenticated.

Sand.

All soils composed of a small stony matter, gravels, and all very light soils, may be classed under this description. Its qualities exceedingly vary, some being altogether unfruitful, others abundantly productive, and others possessing every intermediate degree of fertility. To describe minutely the properties of each variety, and to diversify a scheme of management accordingly, would be a work of much labour, and little use; the only distinction I shall therefore consider, will be between rich and poor soils, classing generally under the first quality, what may be termed gravelly or loamy sands; under the last, all soils principally composed of poor hungry sand. I know no part of England, where the farmers display so much judgment in the culture of their lands, as in Norfolk, where the soil may generally be considered a loamy sand. The Norfolk farmer, with much propriety, considers his land better adapted to corn, than to perennial herbage; his aim therefore is the

rotation of his crops, is not that after a given period, he may return it to grass, in an improved state; but that, by judicious management, he may keep it continually under the plough, without exhausting its fertility. The common rotation (I allude to the practice of the best farmers) is,

Turnips,
Barley,
Clover,
Wheat;

vetches and peas are, however, frequently introduced. This is good husbandry; but when the land, after a period of ten or twelve years, is again to be converted to grass, the system might with advantage be varied. It is necessary that land should not be impoverished, in order to produce a good temporary ley; but when land is laid down permanently to grass, it is of essential consequence to have it in the best possible condition. The success of Norfolk husbandry depends very much on the fate of the turnip crop; if this be great, a plentiful crop of barley is with reason anticipated, and the land being well filled with manure, the succeeding crops are generally abundant: but if the turnip crop fail, what is the consequence? the supply of manure, being small and precarious, is not adequate to the exigencies of the soil, which being greatly exhausted by the preceding wheat crop, requires much support to recover its former fertility. I highly commend the Norfolk practice, as a general system of husbandry on light free land; but I have too often experienced disappointment, from the failure of the turnip crop, to consider it eligible previous to laying down land to grass. When this is the object, it is well to be guarded as much as possible against such an accident.

When old grass land is ploughed up with an intention to keep it for ten or twelve years only in tillage, the crops that I consider most advantageous to take successively, are as follows:

1. Turnips, which on fresh land generally affords an abundant produce,
2. Barley,
3. Clover,
4. Wheat,
5. Turnips,
6. Barley,

7. Peas,
8. Wheat,
9. Turnips,
10. Vetches,
11. Barley, with grass seeds ;

or if another crop of wheat should be desired, every where a *desideratum* with farmers,

Wheat first, then
 Turnips,
 Barley,
 Clover,
 Wheat,
 Turnips,
 Barley,
 Clover,
 Wheat,
 Vetches,
 Turnips,
 Barley and seeds :

it is only in the four last years of the period proposed for continuing the land in tillage, that I wish to vary the common course of Norfolk Agriculture ; if by adopting the amendment I suggest, the produce of grain is lessened, then beef and mutton is obtained ; and the value of the land so much increased, as abundantly to compensate for the deficiency. I consider it a matter of much consequence to take two green crops successively, previously to laying down land ; an abundance of dung is thereby obtained, which helps to restore the vegetative qualities, of which the land, by a succession of crops, is deprived.

We must look to the old school, and to the effects of an opposite system, properly to appreciate the merits of green crops in agriculture. I am sorry to say, such a system has too many advocates. Corn, corn, is the farmer's cry whilst a principle of fertility remains in his land ; when this is exhausted, and under the merciless and injurious treatment it has received, it becomes impoverished and worn out, it is laid down to rest, affording a miserable picture of wretchedness and poverty.

There are sandy soils, frequently composing heaths and warrens, the particles of

which are so disunited, that they scarcely retain the moisture essential to vegetation. From dry hungry soils, like these, much corn cannot be expected; a crop every third or fourth year will be found equal to their strength.

Vetches,
Turnips,
Barley,
Clover,
Wheat, or rye if the land is too poor.
Vetches,
Buck-wheat,
Winter vetches,
Turnips,

Barley and grass-seeds; or a course nearly similar in its principle and effects, will be found best adapted to soil of this description.

It is impossible to prescribe any succession of crops which circumstances may not oblige the farmer to vary; but the total abolition of fallows, the substitution of fallow crops to cleanse and enrich the ground, the culture of corn crops adapted to the soil, and at proper periods alone, must ever form the basis of good management on light soils. I can, from practical observation, assert, that when land is thus cultivated, it may not only be cropped ten or twelve years successively, and then returned to grass without injury, but in an highly improved state. Carrots, parsnips, and potatoes, are useful and very profitable crops, on soils that are deep, rich, and sufficiently light, for the penetration of their roots; but as such soils partake more of the nature of loam than sand, under that head I shall speak of their cultivation.

Draining,

Is an operation not often required on sandy soils: if a retentive subsoil should occasion any superfluous water, the land should be ploughed into broad ridges; the furrows of which might convey it to larger drains cut on purpose to conduct it to some trench, ditch, or rivulet, to be carried off.

A superfluity of moisture frequently arises from springs rising through the soil; this evil is best remedied by Elkington's mode of tapping, a system so well known, as not to require illustration; or by a deep drain cut directly across the declivity where the water first flows, by which means it is carried off from the land that lies below its level.

A redundancy of moisture however is a fault to which soils of this kind are seldom liable; on the contrary, their filtrating and dry nature generally renders it an object of consequence, to attract and retain as much moisture as possible. This is best effected by carefully avoiding to plough, excepting in the winter months, or in moist weather, by having small inclosures, the hedge-rows very high, and by laying the land, when ploughed, perfectly flat.

Depth of ploughing.

I do not plough sandy or gravelly land to a greater depth than four or five inches. I find by shallow ploughing that the subsoil acquires a greater degree of adhesion, and that the operation of manure is more certain; by deep ploughing the effect of manure is considerably diminished; and the soil becomes so porous as to lose its necessary moisture.

Green Crops, &c.

On light soils these crops should be fed off the land, where they grow, the soil receiving great benefit, by being trodden by the animals by which the crop is pastured, whether sheep or cattle; but care should be taken to prevent waste, which is always occasioned when they have access to an unnecessary quantity of food. In feeding off turnips, the hurdles should be removed every second or third day, by which means the whole crop is rendered productive; whereas by too large an allowance at a time, and removing the hurdles only once in a week or fortnight, too much picking and choosing takes place; the outside of the turnip is generally left to rot, and a very large proportion of the whole crop is lost. My mode of feeding off vetches, or clover, is first to mow a small piece, which I give either to my horses, cows, or sheep, in an adjoining grass ground; into the piece so mown, when hurdled off, I turn my sheep or bullocks, employing a man every morning to mow as much as they will consume till the evening, and in the evening to mow a *quantum sufficit* against the morning. By this method no wasteful consumption is occasioned by the animals treading down and destroying the crop with their feet and dung; and I find that they eat their food with a greater relish when served in this manner, and are more improved by it, than when they are allowed to range freely over the whole ground. I hesitate, whether to give a preference to sheep or bullocks in feeding off my green crops. The sheep's superiority is in his manure, the bullock's in his feet.

Ley Land.

Barley is the crop with which grass-seeds are best sown, and on sandy soils, the sorts I recommend, and the quantity of each, are the following: lbs.

Red clover	-	-	-	-	6
White clover	-	-	-	-	4
Yellow clover	-	-	-	-	3
<i>Poa pratensis</i> , or great meadow grass	-	-	-	-	3
<i>Festuca pratensis</i> , or meadow fescue	-	-	-	-	3
Crested dog-tail	-	-	-	-	1

On very light, and poor land, I have seen burnet, sain foin, and *festuca ovina* (sheep's fescue), thrive well, three pounds of each with six pounds of broad clover, and two or three pounds of hard fescue grass, will, for such land, be a very proper assortment of seeds.

I am of opinion that the seeds should be provided by the landlord, on receiving a small compensation from the tenant; he generally has means of information, which the tenant has not, and may be able to procure seeds of a better quality. Good grass-seeds are not often to be purchased in the country, and few farmers will take the trouble of selecting them; indeed the meadow and fescue grasses (which I would particularly beg leave to recommend) are scarcely ever to be obtained but at the shops of the first seedsmen in London. Besides, the landlord finding the seeds, is secure of having those of the description he requires; and is more certain that a sufficient quantity will be expended, than when they are procured by the tenant at his own expence; the seeds should be harrowed in, just previous to the appearance of the barley, with a fine light-tined, or bush harrow, and afterwards well rolled. In the autumn, some time after the crop is carried off, the young plants should have a dressing of manure; they acquire increased strength from it, and are better able to resist the severity of winter. Many farmers, and those intelligent men, mow their young leys the first year, without being sensible of the injury they sustain by it. Feeding is always to be preferred, even on soils in high condition, as the young plants require all possible support, till their roots are well established in the earth. I admit cows and sheep indiscriminately on ley grounds. Sheep bite close, but the injury sustained by their teeth is recompensed by their dung.—Exclude horses, if you value your young grasses.

Clay.

I shall not attempt to investigate the properties of clay, or to explain by the aid of chemical experiment on the presence of what earths or substances, its fertility depends. My object at present not being to ascertain the component parts of soils, or the principles of vegetation, but simply to detail the means by which each soil may be rendered the most fruitful, and best converted to tillage, with a prospect of permanent improvement in grass. The variety of argillaceous soils is very great. A writer in the Philosophical Transactions, whose name I do not remember, enumerates twenty-two distinct kinds. They all contain a proportion of sand, and by far the greater number an admixture of calcareous matter. Theoretical writers on agriculture have frequently divided them into classes, either according to their colours, or their chemical affinities. I shall not attempt an arrangement of this sort, conceiving it only necessary, to detail the course of crops and other particulars of practice best adapted for this soil, as it may be distinguished by being wet or dry, rich or poor, deep or shallow. Deep strong clay generally contain much animal, vegetable, and bituminous matter, and when deprived of superfluous moisture produced the greatest crops both of corn and grass. When rendered foul by slovenly management, or impoverished by severe cropping, summer fallowing is the source of considerable improvement, and may be considered as not only eligible but necessary. It is a practice, however, that I wish to see altogether abolished on the management of lands newly broken up, being convinced, not only from my own experience but from the practice of others, that a proper rotation of crops, on any soil that has not been previously impoverished, entirely supersedes its use. On stiff clays possessing a common degree of fertility, a course somewhat similar to the following will be found worthy of practice (supposing the land to be continued in tillage for fourteen or fifteen years):

Oats,
Beans,
Wheat,
Cabbages,
Winter vetches,
Wheat,
Beans,

Vetches,
Peas,
Wheat,
Beans,
Winter vetches,
Turnips,
Barley seeds.

Although barley seldom succeeds on very stiff clays, a good crop may be produced on most clay lands when drained and pulverised. When the soil is not very moist or adhesive, the following is a very proper succession of crops.

Oats,
Turnips,
Barley,
Clover,
Wheat,
Beans,
Wheat,
Vetches,
Barley,
Clover,
Wheat,
Beans,
Winter vetches,
Turnips,
Barley, &c.

An agricultural writer of great eminence (Dr. Anderson) mentions an instance of a turnip weighing more than sixty pounds, being grown on a clay soil; a sufficient proof that such a soil may, by proper management, be well adapted to that crop; indeed my own experience has fully proved it. With lean poor clays that generally contain much earth of iron (a great enemy to their fertility), much pains must be taken. They must be well drained, well manured, and well and frequently exposed to the ameliorating influence of the atmosphere.

I would not recommend soils of this nature to be kept long under the plough,

their stubborn nature wearies the farmer's patience. Eight or nine years will be fully sufficient to answer every purpose of improvement.

Oats,
Vetches,
Wheat,
Beans,
Vetches,
Peas,
Vetches,

Oats and seeds, are a course of crops that will greatly improve the value of this land when returned to grass, and will repay the expences of the farmer with interest. It is impossible in a treatise like this, to state a course of crops applicable to every variety of soil. The principal characteristic of clay, is the extreme cohesion of its parts, and its great retention of moisture. To increase its penetrability, therefore, that the tender fibres of the roots of plants may search for and acquire the food necessary to their support, and to deprive it of superfluous moisture, by which its vegetation is impeded, are the principal means of improvement.

The time of its being kept in tillage should be proportioned to its degree of fertility, to which the rotation of crops must likewise be invariably adapted;—if rich, more crops for man, if poor, more crops for cattle, should be taken. Very rich clays may without injury, from fifteen to twenty years or a longer period, carry a white straw crop, and a fallow crop alternately every year. On the contrary, very hungry weak clays should bear at least three fallow or green crops, to each of which corn, that by the force of manure, the advantages of hoeing, and the pulverization of the soil, they may be returned to grass in an improved state.

Draining.

It is in all cases eligible to drain land, previous to tillage, where more water is retained in the soil, than is sufficient to answer the purposes of vegetation. On retentive soils, open drains are to be preferred, being far less expensive and equally efficient with those that are covered. The mechanical process of cutting drains, is in general so well understood, that it is unnecessary to give any directions respecting it; the principal object is to collect and to conduct the water off the land, by means

the least expensive; the depth of drains must be proportioned to the nature and moisture of the soil. The ridges of clay land, if there is any declivity, should have a direction parallel with the slope, and be laid up high, that each furrow may act as a drain, to prevent the ground from being drowned or injured by too much moisture in winter. High ridges are likewise a defence to the young corn from the extremities of weather; indeed seeds thus sown are not only better sheltered from high winds, but derive greater benefit from the influence of the sun.

Depth of Ploughing.

The same motives, which induce me to prefer shallow ploughing on dry sandy land, suggest to me the propriety of ploughing clays to a considerable depth, unless where a miserable wretched soil unwelcomely obtrudes itself at the depth of a few inches. My depth of ploughing is at least nine inches, and I find by this practice, that my land in winter is perfectly dry, and my crops have a much better appearance than those of my neighbours on similar soils, which are generally surcharged with moisture. But such is the infatuation of prejudice, that they continue the practice of shallow ploughing with invincible obstinacy. I attribute the principal use of deep ploughing, to its increasing the penetrability of the soil, and affording to the roots of plants a greater quantity of cultivated earth. The adhesion of the soil, is greatly lessened by being well divided and cultivated, and the moisture which principally occasions it and checks vegetation, subsides so low, as no longer to be injurious.

Green Crops, &c.

An inconvenience attends the cultivation of green crops on stiff retentive soils, the nature of which does not admit their being fed off the land; they must always be carted off, unless in particular seasons when the land may be so dry as not to be poached or injured by cattle treading on its surface. I find it profitable, to plough clays in as dry a state as possible, and immediately after the crop is taken away. After mowing my crop of vetches I plough in the stalks, whilst they have leaves about them, and are in a state of succulence, which is of great benefit to the ground; whereas by leaving them to wither, they draw away much nourishment from the earth, and the land loses the benefit of early ploughing in summer, which is of no small advantage to retentive soils. The management of the crop with which grass-seeds are sown, and the treatment of the subsequent ley, should be such, as has been

already directed in a former part of this treatise ; it may be proper however to observe, that sheep are the most eligible stock to feed off the first year's ley, not being so subject to poach the ground as animals of a larger size. I would likewise recommend a proportion of rib-grass seed to be mixed with the clover and grass-seeds ; say 5lbs. rib grass, 6lbs. clover, half a peck of good hay-seeds, or eight or nine pounds of annual meadow, crested dog's-tail, the *poas*, or fine bent grasses, mixed, as they may be obtained.

Loam.

This is the best of all soils, as it equally admits heat and moisture, partaking neither too much of the retention of clay or the dry filtrating nature of sand ; it is commonly composed of clay, sand, carbon, and a small proportion of iron. Loam is calculated to produce a greater variety of crops, and admits a greater variety of management than any other soil. If deep and rich, I know no better succession of crops for twenty years than

Potatoes,
Wheat,
Potatoes,
Wheat,
Turnips,
Carrots,
Barley,
Clover,
Wheat,
Peas,
Carrots,
Barley,
Clover,
Wheat,
Turnips,
Vetches,
Wheat,
Vetches,
Turnips,
Barley. Not having practiced farming for so long a

period, I am unable to describe the effects of such a rotation from experience, but reasoning from analogy, and from a comparative trial of its merits, I entertain no doubts of its success. What I have said respecting cropping on other soils, is applicable to this; fibrous-rooted plants have a tendency to impoverish land, green crops improve it; according, therefore, to the condition of the land, should be the succession of corn or green crops: draining is always necessary when the land is affected by too much moisture; I would recommend deep ploughing on loams, as well as clays, unless very light and dry. A greater surface of soil will be exposed to the atmosphere, and more carbon and fixed air gained from it; the crops intended for cattle or sheep, are best fed off the land, in the manner described on sandy soils. The seeds used, and the management of the ley land, should likewise be the same.

Chalk.

The fertility of this soil depends upon a due proportion of clay or other earths being mixed with it, as in a pure state it is perfectly barren. From a prospect of immediate gain, farmers are tempted in every country to cultivate more corn crops than are beneficial to their land, or profitable to themselves. Land is a most grateful subject; treat it kindly, and it will abundantly repay your favours; neglect and impoverish it, it will soon beggar and impoverish you. I am induced to make these remarks, from having frequently observed the hungry disposition of many farmers on the chalk hills of Wiltshire and Dorsetshire after corn, and having marked its effects on their land. The vegetative qualities are in a few years worn away by a succession of corn crops, and they are obliged to trust to repeated fallowings to restore the vegetable matter, of which it has been deprived by their misguided avarice. Such mismanagement however is not general, the practice of many of the farmers is skilful and enlightened, the value of turnips and other green crops is properly appreciated, and great attention given to their culture; the crops in common cultivation are, peas, wheat, oats, beans, barley, sainfoin, turnips, and clover. From the most experienced information I can obtain, the best mode of converting pasture land of this description to tillage, and after a given period (say 20 years) restoring it to grass, with the greatest advantage to the soil, and profit to the cultivator, is by the following rotation of crops:

Peas,
Wheat,
Turnips,
Barley,
Clover,
Wheat,
Beans,
Wheat,
Turnips,
Barley,
Sainfoin, to remain five years,
Wheat,
Peas,
Turnips,
Barley,
Grass.

If the land is not designed to be kept so many years in tillage, the sainfoin may be omitted; the principal object on this, as on all other soils, must be to keep the land in good condition; not exhausting its fertility by a repeated succession of corn crops. I will not pretend to determine, whether in the neighbourhood of large towns, where manure is to be had in any quantity upon easy terms, it may not sometimes be eligible to take two, or even three, white straw crops in succession. The question appears to be, whether the application of dung, or other manure, increases the vegetative power of the soil in a greater degree than such cultivation diminishes it. In any other respect, however, such a system is ruinous to the land, and must eventually ruin the farmer that practices it. Deep ploughing should be avoided in breaking up chalk soils; they are of so dry a nature, and retain so little moisture, that every means should be taken to increase it. What I have said in respect to draining, manuring, feeding off the green crops, pasturing the young leys, &c. on other soils, will be found applicable to this.

In laying down poor chalky land, I wish particularly to recommend the culture of sainfoin; it will thrive well where clover will scarcely vegetate, and continues much longer in proof. I have known instances of fields continued under this grass

for eighteen or twenty years, and their rent increased from ten to twenty-five shillings per acre. The seed may be sown either with barley or oats, the quantity about four bushels to an acre; the seeds cannot well be too thickly sown, as the sooner they stock the ground, with greater ease they destroy weeds and other grasses. I would recommend the first crop to be mown, not fed, as its sweetness occasions cattle to bite so near the ground, as to prove injurious to its roots, before they are well established in the soil; many farmers sow it in autumn by itself, in this case the land should be well pulverized by repeated harrowing. It is an excellent and nourishing food for cows, horses, and sheep.

Peat, &c.

Having never cultivated land of this description myself, or even seen it cultivated by others, I can afford no other information respecting it, than what I have obtained from books written on the subject. Of these Dr. Anderson's Essay to me appears the most judicious and comprehensive. To this source of information, therefore, I beg leave particularly to recommend all noblemen, gentlemen, and farmers, having peat mosses on their estates.

Paring and Burning

Is a practice, that has been much used, and much abused, in ancient, as well as modern times.

Virgil appears no stranger to its use:

Sæpe etiam steriles Incendere profuit agros,
Atque levem stipulam crepitantibus urere flammis.

Where lands have lain long untilld, and have acquired a sward, either of sour or benty grasses, rushes, heath, goss, or other weeds, whose roots are so hard and matted that they form a kind of board in the earth, through which the tender fibres of the roots of useful grasses in vain attempt to penetrate; or where the tenacity of cold clay soils is so great as to oppose all other means of improvement, paring and burning will produce the most beneficial effects. It not only destroys the weeds and trash which encumber the ground, at the same time that by its heat it wastes the sterile juices that prevent its fertility, but affords a considerable quantity of saline matter that greatly promotes vegetation.

So profitable in many instances is this practice of paring and burning, that I have known land, the produce of which was not worth half a crown per acre, rendered so fertile by its operation, as in the course of four years to produce two good crops of corn, and two of turnips, and to be so greatly improved, as to be rented on a long lease for twenty shillings per acre. But however eligible in the instances I have mentioned, it is a practice to be adopted with caution, and under many restrictions; it is a dangerous method of forcing fertility, on land naturally fertile, or that has been exhausted by long continued tillage; for although it affords a great *stimulus* to vegetation, by its alkaline salts, these have only a temporary good effect, whereas the land suffers a permanent injury, by being robbed of its vegetable mould and carbonic matter, which are in part, if not altogether, destroyed by this operation. In cases where the practice is eligible it is best performed in the following manner:

The work should be entered upon in winter, in order to get rid of the three principal obstacles, viz. water, stones, or such large roots as the paring mattock or spade may not be strong enough to cut asunder. The paring should be begun early in the spring. The turfs cut up should be a foot and a half long, a foot broad, and three or four inches thick, according to the nature of the land. By cutting the turfs of this thickness, the matted roots of all the trash growing on the surface will inevitably be destroyed, a circumstance of essential benefit, as they might otherwise make fresh roots, and injure the growing corn materially. If the weather should be dry, these turfs may be placed a little slanting, by resting the end of one turf upon the extremity of another; but if the weather should be unfavourable, they must be piled up as fast as cut, or even placed upon their ends two and two, being wider at bottom and meeting at the top, like the roof of an house. When the season is not very wet, the turfs will commonly be sufficiently dried in about a fortnight or three weeks, even without being turned, but in rainy weather they require a longer time, and must be turned more than once, to prevent their striking out new roots and shoots, which might hinder them from burning. When the turfs are well dried, they should be piled up in round heaps, about ten feet high, and of the same diameter at bottom, the heathy or grassy side of the turf being placed downwards, and the earthy side upwards. A small cavity should be left in the inside, forming a kind of chimney, facing the wind; as soon as the heaps are finished they should be set on fire, by putting a little lighted straw with a fork down the chimney; the dry heath-grass and roots will catch instantly, and the fire will soon become so violent as scarcely to be

approached; it may then be left, taking proper precaution to prevent its extending farther than intended. When the turfs are thoroughly burnt, the ashes should be spread over the land, which may afterwards be sown and cultivated in the usual manner. In the subsequent cropping, care must be taken not to deprive the land of the advantages it has gained; the common method of taking successive corn crops till the land becomes unable to bear them, is ruinous in the extreme, as its fertility is soon exhausted, and it is afterwards left in a state of irrecoverable poverty. I would recommend turnips as the first crop, the produce will be generally abundant; oats or barley may follow, according to the nature of the soil, then another crop of turnips, previous to which the land should have a light top-dressing of lime; the next year it may be laid down with a crop of barley and grass-seeds. The benefits arising from this management I can, from my own experience, state to be very great. Independent of the profit that the crops will afford, the land will be left in such an improved state as to be doubled, trebled, nay sometimes increased tenfold in value.

It is difficult to define "the principle on which an increase of rent ought to be estimated, where permission may be given to break up old pasture now under lease." The disposition of farmers to over crop their land, has necessarily introduced into leases, clauses to prevent the breaking up of meadow or pasture ground; but were land to be properly cropped, properly cultivated, and properly returned again to grass, after a given period, no injury could arise from it; on the contrary, an alternate course of tillage and pasture, would then prove equally beneficial to landlord and tenant. It is true, that farmers are aware of the riches that are locked up in old pasture ground, and well know the great crops that fresh land will produce; it may therefore be urged, that an extraordinary rent ought to be given, where permission to break up such land is granted. But has not the landlord an equal advantage with the tenant? At the expiration of a lease, in what condition are farms, under the present system of management, generally found? The grass land mossy and unproductive, the arable greatly impoverished by a continued course of tillage. Considering the "convertible husbandry" therefore as an improvement, in which landlord and tenant have a mutual interest, I cannot conceive on what principle an increase of rent is to be expected; but leave, to break up old pasture, or meadow land, should never be granted, but on certain conditions and restrictions, and the non-performance of any of these covenants, should be liable to the severest penalties: for instance, I would have particularly specified the course of crops to be taken, and the

time that the land should be continued in tillage, the manner in which it should again be laid down, and the grass seeds with which it should be sown. The manuring and draining that might be necessary, the mode of consuming the green crops, and all other particulars of management that might be esteemed eligible, should be also stated. In these covenants, the landlord may fairly estimate an increase of rent to himself, and advantage to the public.

CONCLUSION.

The only apology I have to offer for the many inaccuracies that may have appeared in the foregoing treatise, and I trust it will be received with indulgence, is, that it is my first attempt to write on any subject of Agriculture. Conscious of my own inability, it is a task which no stimulus could now have incited me to undertake, but the pleasing hope that I might communicate to the Board of Agriculture, some information, that might prove useful to my country. What I have principally attempted is, to describe a general outline of practice: to recommend any system as proper in all cases, and in all situations, would be an act of folly as well as of mischief, as particular circumstances must ever guide the practice of the farmer. Agricultural theories more frequently mislead than instruct; they may contribute to the growth of agricultural science, abstractedly considered from the practice, but to farmers, they more frequently prove injurious than beneficial. Ignorance is ever dazzled by the charms of novelty; a plausible theory appears, farmers adopt it with avidity, anticipate great gains, and find themselves deceived. The consequence is, that they afterwards treat what they term "book learning" with contempt and disdain, and reject with disgust every improvement that bears a feature of novelty. To convert grass land to tillage, and to revert tillage to grass at proper periods, and in proper condition, is the most essential attainment that agricultural knowledge affords, and must ever contribute, not only to individual, but to national prosperity. I do not hesitate now to express the most decided opinion, that we should not have had occasion to import one grain of corn during any year of the present war, if it were not for the very defective management of the rented lands of this kingdom. As the source of this evil, if we except tithes, we must look to the general want of confidence that subsists between landlord and tenant, and the severe restrictive clauses of leases. These indeed are obstacles to agricultural improvement, and must ever retard its progress whilst they continue their operation.

Of what infinite consequence therefore is it, that the information now sought by the Board of Agriculture, should be fully and satisfactorily obtained. When once such knowledge shall be generally disseminated; when the landed proprietors of the united kingdoms shall excite a spirit of improvement, and rouse industry to exertion, by setting before their tenants examples of superior cultivation; when they shall seek their confidence by mild and encouraging leases, and consider their prosperity the surest pledge of their own: when, on the other hand, tenants shall be awakened by a spirit of industrious emulation, to a proper culture of their land; when, with manly boldness they shall shake off the fetters of prejudice, and renounce the errors of antiquity, universal plenty will prevail, and the industrious exertions of the farmer, we may hope, will be crowned with the greetings of the poor, and the blessing of Providence.

O! fortunatos nimium sua si bona norint
Agricolae! quibus ipsa procul discordibus armis
Fundit humo facilem victum justissima Tellus.

No. XXVIII.

On the convertible System in the Management of Fen Lands. By John Wing, Esq. of Thorney Abbey.

THE following observations "on the convertible System in the Management of Fen Lands," which, with the greatest deference, are submitted to the Honourable Board, are founded on an attention to facts, and the experience with which a situation of most honourable trust and confidence, wherein the writer has been long placed, has furnished him, aided by authentic documents, and the information of his immediate predecessor, comprising the result of attentive observations for a period of at least half a century.

The district which has been the object of their care contains about forty thousand acres, the whole of which may be called fen land; there are intermixtures of high and permanent pasture, but at least thirty thousand acres may be deemed convertible land.

Of the whole forty thousand acres, about one half has more particularly engaged the writer's notice; though with the whole, and with the interests of individuals throughout the whole, he has from time to time been acquainted and connected.

It is about thirty years since a system for the management of this description of land was first introduced, before which there was not any that could be called such; a strong prejudice against the plough under any management prevailed amongst the great proprietors; and the general practice of those who were unrestrained, was to crop the land as long as it would produce any thing, then to let it be overrun with twich (or couch) grass, to which all fen land is prone, and after it had rested a few years to break it up again, paring and burning it without care or discretion. The use of grass seeds was then so little known, that on their introduction on the establishment of the system beforementioned, and for some time after, they were the ridicule of the old fen farmers; nothing in their opinion being so desirable for either grass or hay as twich, the *trilicum repens*. Their rents, rates, and taxes, were then low, their ideas confined, possessing but little, and not being ambitious; to avoid

expence was their chief object. From the fen land not permitted to be ploughed, nothing was experienced but poverty and disappointment; twitch and goose grass or elivers, were the general herbage; the rents were unpaid, the cattle unhealthy, the inhabitants few, and the occupiers of the land continually changing, without property, hope, or exertion.—These are facts too well known to the writer from his situation, and such unerring records as he has officially become possessed of.

But it may be unnecessary to descend to particulars, further than to shew what was the general state of the fens, previous to the introduction of the convertible system, and the nature and good effects thereof in the management of those lands.

The System is as follows :

About one third part of such of the land as is not reserved for permanent pasture, is permitted to be ploughed in each year, taking into the account both cole and corn; the remainder is kept in a succession of grass and tillage.

First year. Pare and burn for colesced; the depth ploughed for burning being about one inch and an half, to be fed off with sheep, which will in general fatten six (or seven) to an acre; hoeing it, has of late been introduced to great advantage, but not set out so thin as for turnips. The most approved season for sowing cole, is any time in the first fourteen days of July, and it should be sowed in the evening of the day on which the land is ploughed, in which case it hardly ever fails to grow. Unremitting attention should be paid during the time of burning, and the ashes spread as soon as made. From neglect alone proceeds the land taking fire, which has furnished objections to the process, but it may always be prevented by proper care.

Second year. Oats, for which they usually plough about three inches and an half deep.

Third year. Oats, barley, or wheat, ploughing about one inch deeper than before; with which it is laid down with grass-seeds for five, six, or seven years; the longer the better; the quality of the corn being always found to be superior, in proportion to the length of time the land has been in grass. Beans, turnips, &c. have all been tried, but have not been found to answer.

Produce.

Of oats, from six to seven quarters an acre, weighing nine stone a sack of four bushels, or thirty-three pounds each bushel.

Of barley, five quarters, weighing fourteen stone a sack, or forty-nine pounds a bushel.

Wheat, from three to four quarters, but of which little, comparatively speaking, is sowed; weight sixteen stone a sack, or fifty-six pounds each bushel.

The broad cast is the prevailing husbandry; dibbling wheat is sometimes practised, but not so generally as might be wished, on account of the saving in the seed; in other respects it does not yet appear here to have any advantage over the former mode; the expences attending it being more, and from observation and comparison the produce at harvest not greater, than from that sowed and managed in the ordinary way.

If an objection should arise to taking two crops of corn successively after cole, it may be observed that fen land will not bear much stirring.

A fallow, by exposing the soil to the sun and air, pulverizes it, and destroys that compactness so necessary to fen ploughed land; and to obtain beneficial cole on a fallow you must manure. This tends to lighten the soil, to encourage weeds, and to cause the succeeding crop of corn to be too luxuriant, and too abundant in flag or leaf; of course the grain will be thin and light; and the grass-seeds, which are usually sowed with that crop (the second), will be choaked and smothered; and by this method the grass land would be deprived of its full quantity of manure, where it might be employed to much more advantage.

Nothing lightens fen land more than frost, nor is more injurious thereto, and to wheat sowed thereon. In the spring after a long frost, it is customary to trample wheat with men, as closely as possible; the expence of it, is about four shillings an acre, and it is found to be of great utility.

The grass-seeds usually sowed on the inferior, or low fen lands, are rye-grass and white clover; two bushels of the former, with eight or ten pounds of the latter on an acre; on the higher, or such as are not liable to be flooded in the winter, of highland, or good meadow hay-seeds, one sack; rib-grass or narrow-leaved plaitain six or seven pounds; white clover from seven to ten pounds, and a

small quantity of rye-grass; all which the tenants themselves provide; and indeed no expence is spared by them in this part of their business. On land of the latter description, a wheat crop is thought to be the most favourable for the growth of the grass seeds; the land so laid down is fed the first year with sheep; the second it is manured; but if mowed, not until after the grass is cut; it is then occasionally fed and mowed until it is again taken up, and undergoes the course before-mentioned of paring and burning for cole for sheep feed, taking two crops of corn in the years immediately following, &c. On some of the higher parts, red clover is sometimes sowed with the first or second crop, and either fed or mowed the next summer, and wheat sowed in the autumn; some, when the wire-worm is suspected, sow cole-seed the two first years after breaking it up, which is an admirable practice, and tends more to the destruction of that noxious insect than any other that has come within the writer's knowledge; others lay their land down with cole-seed the year after the second crop of corn, sowing their rye-grass and bay seeds with the cole, sheep-feeding it in the winter, and sowing the white clover the next spring, a method which is found to answer extremely well; and some without a crop of corn, which is esteemed the best mode for the seeds of any. It is frequent too to sow rye-grass (about a bushel an acre) with the first crop of corn for sheep-feed in the winter, which causes the land to plough stiff, making it more adhesive; but these are only occasional variations of the general system.

Experience shews (and the writer has with very great satisfaction convinced himself thereof), that on every time of taking up and burning the land, the quality of the cole for feeding sheep is not deteriorated, but is as good as that obtained at any former period. That, from very old land is unhealthy, and apt to kill the sheep put upon it: it is also worthy of observation, that by no other means hitherto used can cole of equal quality, or even that will fatten sheep, be procured on fen land; which being the foundation for all the ensuing successions of crops and grass, the necessity for obtaining good, may easily be conceived; indeed the so doing is the grand *desideratum* in fen farming.

Such is the present convertible system in the management of fen lands, no part of which appears to be very defective: it is attended with no difficulty in its execution, may be continued for ever, and the land kept in a constant state of fertility,

requiring no other manure than that which it is in itself from time to time capable of producing.

The good effects of it are, that the rents have been progressively more than doubled; and that such an increase of population, property, the various kinds of cattle, wool, and of animal and vegetable food has arisen, as to give to the country, where it is established, which before was depressed far below its due level, a degree of importance and respectability, which few of the like extent exceed, or perhaps equal.

No. XXIX.

An Essay on the best Means of converting certain Portions of Grass Lands into Tillage, without exhausting the Soil, and returning the same to Grass after a certain Period, in an improved State, or at least without Injury. By Mr. Wright, of Ranby, near Retford.

SOME gentlemen, by whose good opinion I flatter myself I am honoured, and who, (though in different situations of life,) are not inattentive to agricultural pursuits, having put into my hands a printed paper, published by the Board of Agriculture, grounded upon a requisition to that Board, from a Committee of the House of Lords, I have, after much hesitation, and with the diffidence of a man unaccustomed to write for public inspection, ventured to state below, my sentiments on the subject proposed for consideration; in elucidation of which, I have connected therewith short accounts of some facts that have come within my own knowledge, accompanied by such observations as have occurred to me. This I have done in the plain language of a practical farmer, speaking not from theory, but experience; having been brought up under a father, who had large farming concerns upon several different soils, and having since farmed land of various descriptions myself.

The question on which the Board desires an Essay, is, as to the best means of converting certain portions of grass lands into tillage, without exhausting the soil, and of returning the same to grass, after a certain period, in an improved state, or at least without injury; which is followed by an enumeration of the particular heads that the Essay is required to treat upon, in answering such question. Finding on consideration each of those heads so intimately connected with the general question, I thought the general question would be best answered by replying to each head separately, which I have done in the order they stand on the paper circulated by the Board; beginning with cases in which it may be thought eligible to drain land previous to tillage, and ending with the last proposition, detailing the course of crops; having regard to the varieties of soil, and the time proposed for continuing the land under tillage.

Cases in which it may be necessary to drain Land previous to Tillage.

It happens that I have practised this less, than the rest of the modes of improving land mentioned by the Board; I will however presume to suggest, that if the surface, though wet, should be sound enough to admit the plough, it would be advisable to drain *after* the first ploughing; for then the wet parts are more clearly distinguishable; than when in swarth, and the proper line for draining more readily ascertained. For instance; a few years ago I broke up a piece of ground which had higher land adjoining it, from whence the wet came, and broke out upon the surface of the lower land; after ploughing, every wet patch more clearly appeared. I cut a large open drain across the upper part of the wet, or rather between the wet and the dry, to a considerable depth, till I arrived at a white porous sand, from whence the water issued in large quantities. The desired effect has been completely obtained, and the drain has remained open ever since. Where the stratum of sand lies too deep for a drain, pits or holes should be made here and there, or borings with an iron wimble, according to the plan of Mr. Elkington, which is now generally adopted in this part of the kingdom, with infinite success in most cases, but does not apply to all. I have a piece of land, the surface of which is wet, owing to an impervious sub-soil of gravelly clay, not admitting the downfall; after paring and burning, it was ploughed into lands not more than six feet in width; in which case every open furrow acted as a conductor to the lowest part of the field, where an outlet was made. By harrowing in the seed, the open furrows become partly filled with loose mould; therefore it is necessary, after sowing and harrowing, to draw the plough down every open furrow, to clean out the loose mould, for the more free admission of the water to the outlet.

In what Cases Paring and Burning are advantageous, with Directions thereon; regard being had to the subsequent Cropping.

I am sorry to hear the objections of many to this mode of management, under the idea that it diminishes the best soil, which by *frequent* repetition would eventually impair its natural fertility. Plausible as this may appear at first sight, I conceive it is not founded in fact; for on the indefinite term of *frequent*, I shall only observe, that this practice is neither necessary nor profitable upon land *repeatedly* laid down, but upon swarth of ten, or fifteen, and upon some lands of twenty years standing:

then the surface will be so thickly matted with vegetables, that on separating the soil from the pared sod, the soil so taken will be found in quantity very small indeed, and, I may venture to assert, will be more than restored by the returning ashes of the whole. To corroborate this opinion, I will state the practice of a friend of mine, and his father before him, and of others before them, for near a century past. The estate is their own freehold, and has been in the family for many generations. It is thin lime-stone land, in the West Riding of Yorkshire. They have constantly taken up their swarth by paring and burning, after lying in grass about ten years. The soil is so thin in some places that the plough-share scalps the rock, yet no diminution of soil is the least discovered. The course of their crops of late years has been first, turnips, upon the first ploughing after paring and burning, eaten off early, and sown with wheat about the first or second week in the November following; then oats; after that fallow for barley and red clover, mown one year, wheat again upon clover ley, then fallow, and with the fallow crop of barley laid down with grass-seeds. One would suppose if paring and burning were pernicious in the way spoken of, it would be so upon this thin soil, but it has not hitherto proved to be the case, nor is it believed it ever will, if accompanied by proper management in other respects.

I will now state my father's practice in paring and burning upon a soil totally different, viz. a good friable loam upon a clay bottom. In the summer months, when the season promises fair, the paring and burning takes place, and the ashes are spread; (the paring not performed by horses, but by hand;) the whole expence about a guinea per acre. As soon as possible after harvest the ground is ploughed about three inches deep, and sown with wheat, the first or second week in October. And here I must observe, that early sowing upon such soils is very material, as it is, generally speaking, a security for a good crop, if the land be in proper condition. When the crop is reaped the stubble is immediately mown or burnt off, and upon once ploughing sown with wheat again; both crops are generally excellent, the second often as good as the first, averaging about thirty bushels per acre. Oats make the third crop,* and scarcely ever fail to be abundant. After these three almost invariably excellent crops, the land is fallowed, two chaldrons of lime spread per acre, without any other manure, and sown with barley and grass-seeds. This

* The course of crops here recommended is inadmissible.—It is by reason of such courses that the practice of paring and burning has been condemned by so many persons. *Note added to the MS.*

course of cultivation may probably appear to some as likely to injure the land, but I am convinced to the contrary, for lime upon fresh land is more friendly to it than a good dressing of farm-yard manure; this I have proved by experiment, which I will notice in its proper place. Then it should be taken into consideration, how material an improvement is made on the other parts of the farm, by the large quantity of manure arising from those four abundant crops, and which is all an extra quantity, because the fallow required nothing but lime, and which lime would not have had the same effect applied to any other than fresh land, as from experience I can attest. The truth is, that by the course before stated the farms were improved, and the profits, as also the produce to the community increased. But to state paring and burning as an improvement in a clearer point of view, I will suppose a field of old pasture managed as above mentioned, *and unconnected with older land*, it would have its lime upon the fallow, and the whole of the manure arising from the four crops laid upon the grass-seeds. Then what is the result? The Board, I trust, will not hesitate to decide, that by such means lands "are returned to grass, not only without injury, but with improvement." In order to shew the utility of paring and burning with regard to profit, it will be necessary to state what is generally the case where old pasture is broken up by the plough, without previously paring and burning. Wheat is well known *not* to answer as a first crop upon *old swarth*, and therefore Poland oats make the first crop, wheat the second, and beans the third. Which of these two modes affords the most food to man, and profit to the farmer, is sufficiently obvious, without entering into a particular calculation. It frequently happens that the first crop of oats is materially injured by grubs or worms, which have lodged near the surface in the old swarth; but by paring and burning, these insects are destroyed, for I never saw or heard of the ensuing crop being injured by them.

Although I am of an opinion, that paring and burning will answer exceedingly well upon most soils, where the swarth is sufficiently old, yet there are exceptions, namely, upon sand land and sandy loam; of the former I speak from experience, having tried it unsuccessfully, and where loam has a tendency to sand, I am credibly informed, the effect is the same. With respect to the converting of sands and sandy loams into tillage, without exhausting the soil, and returning the same to grass: the most approved practice of breaking up sandy loam or rich sand land, if *very old swarth*, is to sow first Poland oats, then barley, (the oat stubble being twice ploughed,) then fallow for turnips, barley, and red clover, mown one year,

and sown with wheat the Michaelmas following, but not to begin sowing wheat upon such lands sooner than the middle of October, nor to end later, than the first week in November. After wheat, fallow again for turnips, then sow barley with grass-seeds to lie three years, and afterwards take up with wheat, for this grain will answer here as a swarth crop, if the swarth be not very old. These soils being so readily convertible, it is the most profitable mode, to have them in an alternate course of tillage and grass-seeds, red clover to be sown with one fallow crop, and grass seeds with the other, and always to fallow upon the wheat stubble, when once got into a regular course of tillage.

Weak sands I should recommend to be fallowed from swarth, and sown with turnips; and if the land be in sufficient condition, barley after turnips, if not, oats, and here grass-seeds must be sown with every fallow crop, for red clover alone is never found to answer upon such weak soils, for though it may come up and look well in the winter and spring, yet in the summer it will scarcely ever rise to a full crop, even when the land is in the best possible condition. The sheet-anchor here, as to the production of profit, is sheep, therefore the ploughing and cropping should be conducive to the best mode of keeping them, by always fallowing from swarth, after the land has been laid down a few years, and grass-seeds sown with the fallow crop. But there is a middle quality of sand land which may be profitably managed, in the same manner as the loam and best sands, and much improvement is made therein by spirited farmers, whose situations are such as to command extraneous manures; amongst others, the following are found to answer, viz. soap-boiler's ashes, malt sproutings, or comes, rape dust, dove manure, coal ashes, and all dung to be met with in market towns. If farms of this description are well managed, some purchased manures are necessarily required in addition to their own produce, but the manure of their own produce becomes much improved, if the cattle be fed with oil cake along with straw. The quantities of manure to be laid upon such land I should recommend to be as follows:

If Lime	-	-	-	2 chaldrons per acre
Soap-boiler's ashes	-	-	-	4 do.
Coal ashes	-	-	-	5 do.
Malt sproutings, or comes	-	-	-	10 quarters per do.
Rape dust	-	-	-	4 do.
Dove manure	-	-	-	4 do.
Market-town dung	-	-	-	8 or 10 cart loads.

3 T 2

The depth to which Grass Lands should at first breaking up, be ploughed?

Neither swarth nor pared and burnt land ought, in my opinion, to be ploughed deep; the nearer the turf or ashes are kept to the surface, the better; for which reason I recommend that swarth be not ploughed more than four inches deep, and pared and burnt not more than three.

Whether the Crops intended for Cattle and Sheep are to be fed on the Land, and by which kind of Stock; or carted off?

The answer to this question will of course vary with the soil, the crops are grown upon. If cabbages or turnips are grown upon a rich deep loam on the first fallow, after breaking up from old pasture, it will answer to cart off the crop, because if eaten on the land it will be apt to trample, or (what we provincially call) poach in wet weather, and starve instead of thriving the cattle intended to be fed upon it; whereas, if the crop be carted off to cattle in stalls and under cover, it will not only keep a greater proportion of stock, but feed them to a degree of fatness they would not have acquired if fed on the land, and thereby increase the value of the crop, perhaps more than double, and the land sustain no more injury than if the crop had been fed off either by sheep or cattle, and trampled or poached up as before supposed. I mean it to be understood, that this is a kind of soil, which cannot properly be called turnip land, but if in high condition, and rather of a loamy quality, will bear this sort of treatment very well.

Upon land properly calculated for turnips, I am an enemy to carting off, having often known a loss sustained by the ensuing crops, more than equal to the extra profit of carrying off. Where turnips are grown on *very light* sands, I have observed the good effects of feeding them with cattle on the land, the weight of the cattle upon it has a tendency to fasten or compress the soil much more than sheep, which is a desirable circumstance on such soils. In proof of this observation I will state an experiment made by a neighbour of mine. He had a field of turnips on weak sand land, and fallowed out of swarth, as above described. The whole of it had previously been under the same management, and if there was any difference of soil, the cattle had the lighter side of the field, for the sake of compression. It was divided equally, and one side was fed by cattle, the other by sheep. The result was, that he reaped above one third more of barley, in his ensuing crop, from the side on which the *cattle* had been fed. However, I must observe that the eating with cattle

will not hold good on the *best* turnip land, *sheep* being there found to be the most proper stock for profit, and also for the improvement of the land.

The Crop with which the Grass-seeds in each Case ought to be sown, when the Land shall be again laid down?

I never found it good management to lay land down with grasses, with any other than a fallow crop. If it be urged that land may be in such high condition that the seeds will be smothered by the abundance of the crop, I answer, if that is likely to be the case, let another crop be taken before the fallow is made, and if one be not sufficient, take two; for the first thing that ought to be attended to, in laying down with grasses, is, that the land should be perfectly clean, which cannot be the case if there has not been a fallow the preceding year. Wherever this system has been departed from, under my observation, by a greedy and slovenly farmer, they have had cause to repent, for the land not being clean, the grass-seeds are interfered with by twitch, and other noxious weeds, to the great detriment of the crop. But this is not all, for whenever the land is broke up again, the loss sustained by the ensuing corn crops is great indeed, partly owing to the *foulness* of the land, and partly to the improvement it has received from manure in pasturage *being less*, on account of the stock kept upon it having been necessarily fewer in number because of the inferior crop of seeds.

The Sorts and Quantities of Grass-seeds for each kind of Soil, and whether to be provided by Landlord or Tenant?

There has been great error in the general practice of seeding land, the quantity of small-seeds sown not having been sufficient, twelve or fourteen pounds of clover per acre have been the usual average allowance, which I believe ought to be doubled at least. I have seen pieces of seeds, sown with ten pounds of red clover, and an equal quantity of trefoil and white clover, making in the whole, thirty pounds of small seeds, and about three pecks of rye-grass per acre; finer herbage I never saw, and am now clearly convinced of my error in having sown a much smaller quantity. I should recommend red clover and trefoil with one fallow, and white clover and trefoil with the next, and so on alternately. If red clover be sown on every fallow, disappointment will ensue, for by *constant repetition* it will certainly fail; I say certainly, because numberless instances of that have come under my observation.

Experiments on various other grasses, such as lucerne, burnet, chicory, &c. I have frequently noticed, but I have no idea that any of them will ever be adopted in general practice. Nothing that I have yet met with equals the two clovers, trefoil and rye-grass, which I have found to answer upon all soils. Hay-seeds I have an objection to, because it is not easily ascertained of what they consist: much rubbish is often found to be their produce, and the best seed amongst them being *rye-grass*, I think it is better to grow or purchase it pure and unadulterated.

As to whether the grass-seeds ought "to be provided by landlord or tenant," I am almost at a loss what to say. Perhaps it might be right to convince the tenant of the propriety of doubling the quantity of seeds he has been accustomed to sow, by his landlord dividing the expence with him on the first trial; and as he would find it answer, his *own* interest would prompt him to proceed afterwards in the same way.

*Whether it be best to mow or feed the Grass in the first Year after laying down?
To detail the Management in each Case.*

By experience I find it objectionable to mow seeds the *first* year, not only because it weakens them for the ensuing years, but if pastured the first year, the seeds left by the cattle to ripen (rye-grass particularly) will shake, and fill up the small vacancies where the seeds miss, whenever the rain falls to make them grow. I have often known seeds amazingly thickened by this means the second year, and it is therefore my practice to avoid mowing the first year, if possible. I always mow grass-seeds early, viz. about the last week in May, or the first in June, in order to prevent the injury which would be done to the land, if they were permitted to stand till nearly ripe; for when they got into seed, they would take hold of the land almost as much as a crop of corn, and thereby, the intended improvement by laying down, would in a great measure be prevented. But that is not the case when mown early, and in a state of succulency. Of this the grass plots before our houses furnish an instance, for they are constantly and repeatedly mown every year, yet they are not impoverished, though never manured. I am ready to admit that the fodder is lessened in *quantity* by early mowing, but then it is better in quality, which more than compensates for the difference in quantity. The after grass too is superior, and the comparative condition of the land much better. Certainly this practice cannot be followed when *ripe* seeds are the object; but as the fodder is of much less value when the grass is suffered to stand long enough to ripen the seeds, it is most

prudent to let a part of the grass remain for that purpose, and manure it after mowing, to put it upon an equality with that which has been mown early.

I usually pasture my first years seeds by grazing cattle, turned upon them in good condition, being tolerably well kept in the winter with straw and a small quantity of oil cake. The seeds being winter saved, make an early pasture, and the cattle go off fat in June, thereby giving additional room for the other stock left upon the farm the remaining summer months. This, however, is not all, for another advantage would arise from pasturing the first years seeds with cattle instead of sheep; the bite of the sheep being so much nearer to the root of the young clovers than the bite of cattle, the future herbage becomes comparatively more impaired, and weakened thereby. This I have tried, and have found the difference in the effect greater than persons who have not done so would suppose.

The Manuring which may be thought necessary.

The enquiry of the Board being directed to the converting grass into tillage, and returning the same to grass, after a certain period: I consider lime, as the most valuable dressing for such lands, on the first fallow, after being broken up from old swarth, which I have experienced upon a variety of soils with success, the effect having been equally good, whether tried on loam, clay, or sand. A few experiments of this kind I will take the liberty to mention. When I first began the cultivation of the farm I now reside upon (being sand land) I found a part of it in its original state of forest. After burning off the furze, and preparing it for lime, by ploughing, &c. I spread two chaldrons an acre over the whole field, except two strips of land, ten yards each in width, extending across in different directions, one being from north to south, the other from east to west, so as to embrace all the various qualities to be found in the soil. The consequence was, that where the lime was spread, my success was equal to my hopes, but the two strips of land unlimed were visibly different, even at a great distance, for they failed in every crop, viz. turnips, oats, and seeds.

On another field, also sand land of old swarth broken up the year following, and limed in the same manner, except about an acre in one corner, of evidently stronger and better land than the rest, which acre was pared and burnt, and seemed to afford plenty of ashes. The effect of the lime was *the same as before*, the pared and burnt part being but little, if any, better than the two strips above mentioned. When the

last field was afterwards in fallow, the whole was manured *alike* with fold-yard dung, yet the pared and burnt corner proved infinitely inferior to the other part of the field, and I suppose would have remained so had it continued unlimed.

Not knowing then so well, as I now do, that lime, however good it might be in such cases, should nevertheless be used with a sparing hand; but flushed with the success of these experiments, I increased the quantity from *two* chaldrons per acre to *four*, upon a fallow, which had been limed the fallow preceding. I failed completely, for I had neither turnips nor corn, nor do I think the field has perfectly recovered it to this day.

Upon land which has been long in a course of tillage, lime has by no means that good effect. For a few years ago I took a farm of nearly the same quality as the above, but which had been long in tillage. On one of these exhausted fields I limed, leaving a small part unlimed, for the sake of experiment. The unlimed was equal to the rest in turnips and corn; and though the seeds had rather a fresher appearance when limed, yet in the corn since the seeds there was no perceptible difference.

Upon the result then of experience, and also the corroborating information obtained from very intelligent men, I shall venture to draw the following conclusion as to the acting properties of lime. That lime, though perhaps not possessing one particle of fertility in *itself* as *manure*, has a stimulative power of enforcing to action the food of plants found in land long unused to tillage, or land made fertile by high management; for I am thoroughly satisfied in my mind, not only from my own experience, but from all the information I have been able to collect, that lime upon exhausted land is not of the least service.

That there is great difference in limes, I admit; but my notion is, that they all act upon the same principle, some in a greater and some in a less degree. If the far-famed Derbyshire lime be brought in contradiction to this, I have only to say, that I have observed its wonderful effects upon its own heaths, and yet believe its principle of action to be the same as before stated; for at the time it is destroying the plants to which it is an enemy, it may be exciting to action, the food of those plants which flourish so much in consequence of liming.

On the first fallow, after old pasture is broken up, I will venture to assert that lime has not its equal in real good effect, whether the soil be clay, loam, or sand, including all their distinctions, and if it be intended to lay down with grass-seeds,

no other manure ought to be added, on account of the danger of the seeds being smothered by the rankness of the corn. If grass-seeds are omitted in the first fallow, red clover alone may be sown instead, and mown one year, and sown with wheat the Michaelmas following. But here let me observe, that the time of sowing should vary with the soil; the seed time on clays (the season permitting) should commence about the last week in September, and end by the middle of October. On dry loams or sands, it is (as I have before hinted) better to begin when the other ends, and finish not later than the first week in November. Sowing well timed, and seed well got in, make a most material step towards a good crop.

After wheat, beans should *sometimes* be taken upon strong land, and peas upon lighter soils, afterwards wheat in both cases, then fallow, manure (and turnips upon proper soils) and grass-seeds with barley, as the fallow crop. But this does not meet my ideas of proper management, so much as laying down with the crop on the first fallow after breaking up: for then, the soil has thrown out its nutrition *sufficiently*, and produced abundance with the least possible expence, and returned to grass without injury to itself, and with great improvement to another part of the farm, which may have been long tilled, but *may* then be laid down in lieu of the old swarth so taken up; and such management would be very proper, particularly if the new broke up land be intended to continue in tillage longer than the first fallow. The foregoing observations relate to lands, the leading qualities of which are loams, good sands fit for turnips, and also *friable clays convertible*, so far as relates to grass and tillage; but clays that are not so, namely, the *very stiff* kind, I would on no consideration allow to be broken up from tolerable swarth, if any regard be had to future laying down. The ruinous consequences of this practice I once experienced, and have often witnessed where valuable old pasture has been broken up, but never reinstated to its former value, as grass land; after being well managed during the cultivation, and also in the laying down: when the clovers are gone (and they soon go upon this land), it will remain with a poor, thin, staring coat of herbage, during a man's life-time, and perhaps longer. I never yet found an instance of its being restored, or nearly so. Therefore the breaking up of this land is not *only* an eventual loss to the tenant, but to the inheritance.

Soil of the last description is found more or less in Lincolnshire, Rutlandshire, Leicestershire, Northamptonshire, and Warwickshire. But in all these counties, great stores of plenty may be found buried under the sod, which might be turned up

by the paring spade, and after proper cultivation, be returned to grass with improvement. There are farms, and even lordships, in those counties, to which the plough has been unknown for ages past; and if the *convertible* parts were permitted to be broken up under proper restrictions, the result would undoubtedly be, an increased rent to the landlord, more profit to the tenant, and a large quantity of additional food to the community.

The Principle on which an Increase of Rent ought to be estimated, where Permission may be given to break up old Pasture now under Lease.

I have great difficulty in answering this question, because various circumstances are required to be taken into consideration, before any principle can be fairly laid down; for *rents* frequently vary as to the real annual value of grass land; therefore if it be said that the increase shall be proportioned according to the present rent, there would of course be great inequality; for where the present rent is low, the proportion of increase might not be sufficiently high, and vice versa. Under leases *near their expiration*, we must presume the rent to be considerably *below* its present yearly value as grass land, which cannot be supposed to be the case where leases have been recently granted; so that it would not be a fair general criterion to proportion the increase to the present rent, unless all rents were equal as to the real value of the land. There would also be a difference in the value of this permission to tenants, if they held at the same time other lands long had in tillage, and which would be much improved by laying down, and the manure laid upon them, arising from the old swarth so suffered to be broken up. Again, it would make a difference whether the whole of their farm were in grass; in which case the farmers must necessarily be at the expence of purchasing horses, implements, &c. for the purposes of tillage. It should be considered also, whether the increased rent is meant to be permanent, or to cease in part, or altogether, as an increase when the land in question is returned to grass, and likewise how long it is to remain in tillage; whether the land be *in the free* or not, if taken in kind, or a moderate and certain composition paid in lieu. Under these, and other various circumstances which may occur, I feel much difficulty in offering a general principle to be acted upon in all cases, where this permission is meant to be granted. However, I will with deference offer my opinion on two supposed cases. First, suppose then, I am a tenant under lease, upon a farm, part tillage, and part old swarth, prohibited by the lease from being

ploughed, (tithe not being taken in kind,) I would give double the sum per annum for *that land*, with a permission to plough, than I would to hold it without such permission, and be restricted in the management by any of the rules I have herein specified. After laying down, perhaps the *whole* of the increased rent ought not to cease, because the farm would be improved by the breaking up of this land, if properly managed; therefore about one-third of the original rent of the old swarth so broken up, should remain as a permanent increase. Again,—Suppose I farm all grazing land, and should have this permission granted; as far as that extended, the increase might be nearly in the same proportion, except that some consideration should be made, on account of the extra expence I must be put to, in making the requisite provision for this cultivation, and which consideration would be governed by the extent of the permission.

I feel the more cautious upon this part of the subject, having heard that the tenants of a noble lord (who I hope will honour these sheets with a perusal,) were induced, by the high price of corn in 1795, to solicit his lordship for this sort of permission, with an offer of increased rent; which offer was accepted by the landlord, and agreed to by the tenants; but the increase being found too high, the tenants most certainly would have been ruined, if his lordship had insisted on the contract being completely fulfilled; but which he had too much humanity to do.

If I have extended this Essay to too great a length, it has proceeded from my anxiety to communicate useful information, and it will be a source of much satisfaction to me, should what I have written be acceptable to the Board, or of service to my country.

No. XXX.

An Essay on the best Means of converting certain Portions of Grass Lands into Tillage, and returning the same to Grass without Injury to the Soil. By Lieut. Colonel Vavasour, Melbourne Hall, Pocklington, Yorkshire.

THE Board of Agriculture being desirous of receiving communications on the subject of converting grass land into tillage, and of returning the same to grass, without injury to the soil; I beg leave to offer some observations on that practice.

When the method of returning land to grass, by sowing the best grasses, was little understood; and soils, exhausted by successive crops of corn, were left to acquire such a covering as nature should afford them; it is not to be wondered at, that landlords were particularly attentive, by covenants in their leases, to prevent the breaking up of their old meadows, or pastures. It is also much to be regretted, that the ignorance, or rapaciousness which some tenants discover in their courses of crops, after breaking up old grass land, should still render great caution necessary in granting permission to plough up old grass.

Whoever has paid attention to the state of agriculture in this kingdom, must have observed many thousands of acres of grass land so over-run with moss, rushes, and other unprofitable plants, as to be of little value in their present state, either to the occupier, the landlord, or the community: if leave were to be granted, under proper restrictions, to convert these lands into tillage, for a limited time, there can be no doubt of their being made to yield a considerable supply of grain to the community, or of their being afterwards laid down to grass, in such an improved state, as to enable the tenant to pay an increased permanent rent. The first soils to be considered, are,

Clay Soils, and such as are too strong or wet for Turnips.

These soils are, in general, peculiarly well adapted to the growth of beans and wheat. Beans, on a strong soil, when kept perfectly clean, are found an excellent preparative for wheat: they are sown with success, on one ploughing of old-grass; they may be dibbled in, or drilled. I have found twenty-seven inches, or every third

furrow, a proper distance to admit of cleansing, and earthing up the rows with a plough, having two mould-boards, which may be extended or contracted at pleasure; the plants are also to be carefully hand-hoed, and weeded in the rows. After the crop of beans is got off, the land should be immediately scuffled, or ploughed very thin, and the weeds harrowed out, and burnt; after which the land is to be sown with wheat on, one ploughing. As soon after the wheat is harvested as it can conveniently be done, the stubble should be mowed, and carted into the farm yard for litter; the expence of this is trifling, and the increased quantity of manure thus obtained, considerable: the land should then be ploughed thin, and laid up for the winter.

Instead of making a summer-fallow on this soil, I should wish to recommend the cultivation of cabbages, as a good preparation for spring corn and grass-seeds. The advantage of a crop of winter food for cattle on land too strong for turnips, and which on an average will amount to forty tons per acre, must be readily acknowledged; even to a farmer, who may possess turnips in abundance, a supply of cabbages during a severe frost or snow, will be particularly useful in saving of hay; and the value of the cabbages being equal to that of the hay, thus saved at such a season, they must be esteemed inferior to few crops, in point of profit; of this I can speak from experience. The method I pursued in cultivating cabbages has been as follows; the seed was sown early in the spring in a garden, the soil good and well manured; the field to be planted being got into good order by sufficient ploughing and harrowing, furrows were opened lengthways of the land, at three feet apart, by a double mould-board plough, these filled with rotten dung, at the rate of from twelve to fifteen tons per acre, the manure was then covered up by a plough, which formed a ridge of earth over it; these ridges were then flattened by a roller, which also consolidated the earth and dung. The young cabbage plants having been some time picked out from the seed bed, were taken up, and dropt upon the ridges by women and boys, before the planter, who put them in with a dibble at three feet distance, so that an acre contained 4840 plants. The plants earthed up very well with a double mould-board plough, and hand weeded in the rows. The cabbages should be all planted out by the middle of June.

The succeeding crop to be barley or oats, and grass-seeds, to return the land to permanent grass. If the soil be naturally wet, it will be proper to form it in broad lands, gently arched; and if the grips, or water furrows be kept clean and open, this

land may generally be laid sufficiently dry. But if hollow drains should be found necessary, they may be filled with such materials as are always to be obtained, such as brush-wood, straw, or stubble; when the soil is strong, as the straw decays, a clear passage will be left for the water, the clay forming an arch over the drain. No general rules can, I apprehend, be laid down for the situation or distance of these drains, as almost every field must require a different disposition of them. This course of crops will be,

1. Break up the old grass by ploughing six inches deep, dibble, or drill beans,
2. Wheat,
3. Barley or oats, and grass-seeds, viz. 10 lbs. white clover; 5 lbs. burnet; 5 lbs. rib-grass; and 5 lbs. trefoil.

There is a kind of strong soil, which is commonly called cold clay, at once the most uncomfortable and unprofitable soil to cultivate; in very wet weather sticking to the plough like mortar, and when dry, it is almost as hard as a brick-floor. Should this land fortunately have remained long unploughed, it will have acquired a thick, tough covering of vegetable matter, and when this is the case, it may be greatly improved by paring and burning: it would be proper to pare off as thick a portion of the surface as the turf is capable of calcining. Whoever may have observed brick-dust, or bricks broken very small, accidentally scattered on this soil, must have seen its good effects. This, I think, can only be attributed to the mechanical action of the calcined clay; by opening, and dividing the soil, which will render it less retentive of water, and more easily perforated by the roots of plants. When this cold clay land is pared and burned, it may be sown with rape, (or cole,) to stand for seed; this crop will often succeed on such a soil, when newly broken up, and is very profitable, being sometimes equal to the purchase value of the land. It would pay well to put ten or twelve tons of dung, or four chaldrons of lime, per acre, before the rape be sown. This crop will be harvested early enough the following summer to admit of getting the land into fine order for wheat. Cabbages well cleaned and manured may succeed the wheat, as a fallow crop, to be followed by oats and grass-seeds; barley seldom answers upon this soil. I have laid land down to grass with good success on a strong soil, as well as a loam, with the following seeds: viz. 5 lbs. white clover; 5 lbs. trefoil; 5 lbs. rib-grass; and 5 lbs. burnet; and also on the same soils with 10 lbs. white clover, and 10 lb. trefoil, per acre. I

have reason to speak highly of burnet, and observe, that in a field laid down with a mixture of this grass, amongst others, though in the middle of winter, the burnet is perfectly green, and four or five inches high. Some very rich natural meadows in this neighbourhood let for £.3 per acre, abound with this grass. Of some other grasses, as the fox-tail, crested dog's-tail, the poas, &c. though I am now cultivating them on a small scale, as an experiment, I cannot speak from experience; and I do not know that they can be procured at present, genuine, in large quantities.

Loam in all its distinctions, fit for Turnips.

The occupiers of this soil are enabled to produce every crop which can be cultivated in this climate; the course of potatoes and wheat, as it furnishes the greatest quantity of food for man, is the most advantageous to the community.

Where manure can be obtained in large quantities, this course, as has been proved by experience, may be continued for a great number of years. I have observed in Ireland, that it is their common practice to improve their rough uncultivated land, by digging it and planting it with potatoes, which are generally followed by wheat. Though the practice of sowing wheat, after potatoes, has been censured by some writers on husbandry, yet it has been adopted by many excellent farmers with success. I have myself seen very good crops of potatoes after wheat, on soils by no means remarkably rich. I beg leave to recommend, that the old grass be broken up by paring off the turf, with a plough very thin, and laying it at the bottom of the next open furrow; the potatoe sets are to be planted in every third furrow without dung, on the inverted turf, and a second plough following, covers them with three or four inches of mould. When the plants appear above ground, they should be harrowed lengthways of the rows; a few days after which they are to be earthed up with a plough having a double mould-board, and drawn by one strong horse, and to be kept clean hand-hoed in the rows; this earthing up and cleaning to be repeated two or three times. As the land will be made very fine by ploughing and harrowing up the potatoes, the wheat may be sown immediately after the crop is off. The year following after the wheat is harvested, the land should be ploughed before the winter; in March it may be ploughed again; about the middle of May, a third time, four inches deep: dung is to be raked into every third furrow at the rate of twelve or fifteen tons per acre, and the potatoe sets placed upon the dung at ten inches apart;

if the soil be rather strong, long litter will be the best manure; if of a lighter nature, dung well rotted will be more proper. The manure, together with the potatoe sets, are covered by the plough four inches deep with earth. After this second-crop of potatoe, the land will be in good order to sow the year following with barley, and grass-seeds, to return it to grass. This course will be,

1. Break up for potatoe,
2. Wheat,
3. Potatoe,
4. Barley and grass-seeds, to return to permanent grass.

Old grass will generally produce a large crop of oats at one ploughing; these may be followed by turnips manured and well hoed; the third year, barley and grass-seeds. Potatoe may often be substituted for turnips on this course with success.

This soil, *as well as every other*, where the herbage is coarse and rough, may (I think) be pared and burned with advantage, if the operation be properly conducted. Though the soil cannot be consumed by the action of fire, its properties may be greatly altered; clay may be burnt to brick, and sand become vitrified. The calcining of clay, I mentioned as a great improvement, when considering the nature of that soil: to effect this, the vegetable matter must be consumed as fuel and reduced to ashes; but on other soils, where it would be injurious to excite so intense a heat, it is only necessary to burn the turf to a coal. In reducing vegetables to ashes, these substances are decomposed, and about nineteen parts in twenty are dissipated; but when converted into charcoal, they are not greatly diminished in bulk though much reduced in weight. I shall not attempt to enter into any disquisition on the food of plants, of which charcoal is now supposed to form a large portion; many farmers have experienced the good effects of cinders as a manure, and though ashes are a good dressing, particularly on strong soils, the quantity of these to be obtained from vegetables is very small, when compared with that of cinders or charcoal. It will be proper in every soil, clay excepted, to burn the turf only so much as may be necessary to destroy vegetation, without dissipating the greatest part of the vegetable matter, which may be done by admitting no more air into the heaps of sods, than is sufficient to maintain a slow fire.

On this soil, (loam,) 10 lbs. white clover; 5 lbs. trefoil; 5 lbs. burnet; 5 lbs. rib-grass; and one peck of ray-grass, will, I have reason to believe, if sown with the barley, make a good pasture when the land is to be returned to permanent grass.

The sowing of ray-grass (*lolium perenne*) has often been condemned; and indeed when this grass is suffered to run to seed stem, it is generally disliked by cattle; it ought therefore always to be eaten down early in the spring, when it affords an excellent bite for stock, at a time when very few plants have begun to shoot out. I have cultivated cow-grass, (*trifolium alpestre*), but though very productive, I have not yet had sufficient experience of its duration to recommend it as a permanent grass.

Sand, including Warrens and Heaths, as well as rich Sands.

There are few crops which are cultivated on loams, which cannot be grown to advantage, on a rich sand; but the crop to which this soil is peculiarly well adapted, is carrots. Where the grass is not very rough, carrots will succeed well on one trench-ploughing; this may be done very well and at a small expence, by a skim affixed to the coulter; this skim pares off and turns over a thin turf, and the plough following, covers it by turning a furrow upon it, so that when ploughed with this instrument, the land appears like a well tilled fallow: this may also be done by a trenching plough, or by two common ploughs following each other. If the soil be of a good depth, it may be trenched as deep as the ploughs can go; about Lady-day the seed is to be sown, four or five pounds per acre; as soon as the young plants can be distinguished, they should be carefully hand-hoed and weeded, which must be repeated as often as may be required, to keep the crop free from weeds; the expence of cleaning this crop will be heavy, but it will be amply repaid by the produce; four hundred bushels may be considered as an average crop on this soil, (rich sand,) when fresh broken up from old grass, and they cannot be estimated as worth less than 6d. per bushel for horses; they are at present worth three times that price.

I have found that the tops may be mowed for feeding horses within the stable, without injury to the roots, and that an acre of good carrot tops is little inferior to an acre of clover: it is said that the tops can be made into good hay; of this I cannot speak from experience, not having yet tried it. My horses are now eating carrots and hay, they have no corn, they plough an acre every day, and are in good condition. Carrots are sometimes taken up and thrown upon the land where they grew, to be eaten by sheep; but this I cannot consider as an advantageous method of consuming them. The carrots should be followed by barley, which is generally more productive than when it succeeds turnips: the barley stubble should be ploughed

before winter, and a second ploughing early in the spring should follow; after which, from 12 to 15 tons of manure are to be laid on per acre, which being ploughed in, carrot seed is to be sown directly, that the weeds may not have the advantage in growth over the carrots. The fourth year, the land to be returned to grass, with barley and grass-seeds; viz. 10 lbs. white clover, 5 lbs. burnet, 5 lbs. rib-grass, and 2 peck of ray-grass per acre.

This course will be,

1. Carrots without manure,
2. Barley,
3. Carrots dunged,
4. Barley and grass-seeds.

It may often happen, that from the vicinity of a market, or other causes, it may be eligible to cultivate potatoes on this soil in place of carrots.

Warrens and Heaths.

Paring and burning, I am well convinced by experience, is the best method that can be adopted of bringing these lands into cultivation; unless the season be peculiarly unfavourable, the burning and spreading the ashes may be finished in proper time for sowing turnips and rape: these are to be sown on one thin ploughing, the seed to be harrowed in by a bush or thorn harrow. The paring and burning will generally insure a good crop on fresh land; but if lime can be procured at a moderate expence, it should be laid upon the land immediately after the ashes are spread, the quantity not less than four chaldrons per acre; this will be of great service to the succeeding crops; the turnips or rape to be fed upon the land with sheep. As it should be the object, wherever marle can be found, to get this land sown to grass as soon as possible, with a view to marling or elaying on the ley; for this reason, the second crop should be again turnips fed off, to be followed by buck-wheat, of which one bushel per acre will be sufficient to sow, together with 14 lbs. of red clover.

As warrens or heaths cannot be laid down advantageously to grass until they have been several years in cultivation, and frequent ploughing and harrowing being necessary to give full effect to the marle, which is to be considered as the greatest improvement on these soils, it will therefore be proper to plough up the clover the second spring after sowing, if the marling has been finished early in the preceding

winter; and if not, then the third spring after sowing, as the marle should have the benefit of one winters' frost to break down and divide it. With this view, I have practiced the sowing of red clover, as affording the heaviest crop of grass for one or two years. The clover may be cut once for hay, and afterwards fed whilst the marling is going on. I have cultivated buck-wheat on a sandy soil for some years in considerable quantities, and have found many advantages in adopting this crop, when grass-seeds are to be sown with corn for the purpose of laying down land.

As this crop should not be sown until about the first of June, there is time sufficient to bring the land into very fine order; the seed vegetates so quickly, that the surface is covered by its broad leaves in eight or ten days after sowing, and the grasses whilst young are shaded from the too powerful influence of the sun; and from the openness of the buckwheat at the bottom, they are in no danger of being smothered by that crop.

The 1st course, on warrens or heaths, will be, pare and burn, and lime for turnips or rape, fed off with sheep,

2. Turnips,
3. Buck-wheat,
4. Clover marled.

Under a poor sand, a stratum of clay marle or other substance peculiarly adapted to give fertility to this soil, will generally be found. Nature seems to have designed that no land should be unproductive, and if any be unfruitful, the cause is in the ignorance or indolence of man. If clay marle can be had at a convenient distance, seventy-five tons, or cubic yards, per acre, will be a good covering; if of a shelly or soapy marle, twenty or twenty-five tons may be sufficient. The marle after being spread, should be repeatedly rolled and harrowed, to divide and pulverize it the better. The clover, after being marled, may be sown with pease at one ploughing; the hoeing of the pease will assist in dividing the marle; wheat may follow; to be succeeded by turnips; after which the land may be laid down to permanent grass, with barley or buck-wheat, and 14 lbs. of white clover, and one peck of clean ray-grass per acre; trefoil is generally found to wear out soon on these soils. The course after the marling will be,

1. Pease, on the clover ley,
2. Wheat,
3. Turnips fed upon the land,
4. Barley, or buck-wheat, with grass-seeds.

A few years since I purchased, with other lands, a field of ten acres; it had been part of a common, inclosed about fifteen years before, and was tithe-free, the soil sandy, mixt with moory earth; after being greatly exhausted by cropping, it had been left to nature for some years. As there was not a strong turf to burn, I ploughed and sowed it in divisions with various crops, as an experiment, most of which failed, owing to the exhausted state of the land. Having discovered a stratum of rich clay marle within four hundred yards of the field, I carted on seventy-five tons per acre; the earthing, filling, and spreading, was done for 7*d.* per ton, the digging at 3*d.* per cubic yard, so that the cost was about £.3 per acre. The marle was spread over the whole field, one land-ridge only excepted, which was left unmarled as an experiment. The land was sown with white pease, the crop good, except that land which was left unmarled, on which the pease were thin and sickly, much choaked with weeds, and scarcely worth reaping. The crops after marling, were pease, oats, turnips, oats. When about to purchase this land, I requested a professional man to look it over: he assured me that it was not worth more than 6*s.* per acre to rent; soon after marling, it was valued at a guinea. I have since let it to a tenant; it forms part of a farm of one hundred and fifty acres, for which he pays one hundred and seventy pounds per annum, or 22*s.* 6*d.* per acre, and this field is esteemed equal in value to any on the farm. The crops whilst in hand paid every expence, including marling, together with 4 per cent. interest of the purchase money.

Chalk Lands and Downs.

Of this land I beg to be understood as saying nothing from experience, never having cultivated any land of this description; but living in the neighbourhood of very extensive wolds, or downs, a great part of which have been broken up within a few years past, I have had some opportunity of observing the great improvements which have been effected. Land which, when in sheep-walks, did not let for more than 5*s.* per acre, has been raised to 20*s.* A greater quantity of stock has been maintained, and a large supply of corn brought to market from a district which did not produce sufficient for home consumption. The population is increased by the demand for labour. Sainfoin is the grass which affords the greatest produce on these soils, yielding a heavier and more valuable crop of hay than the richest meadows.

The most approved mode of breaking up these lands is to

1. Pare and sow turnips or rape,
2. Turnips, both crops fed with sheep,
3. Barley, with four bushels of sainfoin-seed per acre, the sainfoin mown for hay.

Peat, including moory, sedgy, rough Bottoms, and Fens.

These soils, of which such extensive tracts remain uncultivated, both in Great Britain and Ireland, are, when improved, of all soils the most productive. The first object in the improvement of these soils is to bring the water to a proper, constant level, for it is as necessary to keep it up to a certain height in dry seasons, as to carry it off the land in times of floods. For this purpose it will be required to find the lowest possible out-fall. If the water in the drains be liable to be forced back upon the land by high tides or floods, it will be necessary to place sluices with gates, to remain always shut when the pressure or height of the water is greater on the outside than in the drain. The ditches, which will be required to divide the land into proper inclosures, may be made to answer the purpose of drains; they may be made eight feet wide at the top, three at the bottom, and five deep, having six inches slope to every foot in depth. If the land be very soft, it will be necessary to dig the ditches only to half the intended depth at first, and to give time for the sides to dry and harden, after which they may be dug to the full depth. Hatches should be placed at the outlets of the ditches, that the water may be kept up in summer, if possible, to within eighteen inches or two feet of the surface. A drain should be conducted along the edge of the firm, or higher ground, to intercept and carry off the water, which would otherwise run into the fen or moss. If covered drains should be thought necessary, they may be formed of materials which these soils always supply: a trench may be dug eighteen inches wide at the top, twelve at the bottom, and eighteen deep; after this has remained open a sufficient time for the sides to become hard and consolidated, a smaller trench is to be made at the bottom of the first, with a spade adapted to this purpose; this smaller trench to be eight inches wide at the top, four at the bottom, and twelve deep; a turf which has been taken from the surface, of a proper size, and exposed to the air to dry and harden, is to be laid over the top of the lower trench, resting on the two shoulders made to receive it; after which the drain may be filled up level with the surface. Where the lands

are very wet, these hollow drains may be made at from twenty to twenty-five yards apart.

The draining and dividing of these lands being effected, it will be necessary to destroy the coarse, sedgey herbage, with which these lands are usually covered; this being of a very tough, inert nature, cannot easily be decomposed but by the action of fire. In burning upon these lands great caution is required, the soil being composed to a considerable depth of vegetable matter, and inflammable; unless the fire be watched with much attention, it will proceed downwards until stopt by the water; when this happens, its progress may be stopped by cutting a trench round it.

Potatoes are the crop which will best pay the heavy expence of bringing this land into cultivation. Where the ground is uneven, or too soft to bear the weight of horses, the lazy-bed method will answer the best: the land is to be dug into beds of six feet broad, with intervals of two feet; the potatoe sets to be dibbled in at ten or twelve inches distant every way: when the tops appear above ground, earth is to be dug out of the intervals, and thrown upon the beds, covering them about two inches deep; the crop to be kept clean by hand-hoeing and weeding.

This soil will generally produce a good crop of potatoes the first year without manure; but if four chaldrons of lime be laid on per acre, it will be a great improvement to the soil.

The second year potatoes may be again planted in the same manner, excepting that from fifteen to twenty tons of rotten dung may be dug in per acre: the following crop to be oats, with 14 lbs. of white clover; 5 lbs. of burnet, and one peck of ray-grass per acre. I have observed much burnet growing naturally in very productive meadows in this county (York) the which are of a moory or peaty nature. The meadow soft-grass (*holcus lanatus*,) grows very luxuriantly on these soils, but it is thought here a coarse, bad grass, and cattle are observed to dislike it. In some parts of the kingdom it is cultivated under the name of Yorkshire white-grass; perhaps where it is not the spontaneous production of the land, it may grow less harsh and coarse, and be more relished by cattle.

Cabbages may be substituted for potatoes the second year, if more convenient, as they grow to a great weight on these soils. The course will be,

1. Pare, burn, and lime for potatoes,
2. Potatoes or cabbages, with manure,
3. Oats and grass-seeds.

The grass should be fed with sheep for two or three years, as the carting off the hay, or pasturing the land with heavy cattle, would be injurious. Sheep, it is observed, do not rot on moory soils when well drained.

About three hundred acres of low, moory land, part of an estate in which I am interested, were drained, by Act of Parliament, about thirty years since. This land, before the drainage took place, did not bring in to the landlord more than 1s. per acre: after the main drain was cut, the land was divided into proper-sized inclosures, which were annexed to the adjoining farms: this land is now let at an average for 20s. per acre.

It fortunately happens, that the addition of almost any substance to this soil, (peat) will greatly improve it, as marle-clay, sand, or loam: it will be most advantageous to lay these on when the land is under grass, for though a thick covering of earth on the grass will be rather injurious at first, yet it will greatly improve the soil ever after, and the land which before was too soft to bear the weight of any other stock than sheep, will, by these means, become sufficiently firm to sustain the heaviest ox. A gentleman farmer in this neighbourhood, a proprietor of land of this description, has carted on to it one hundred tons of sand per acre, and found the greatest advantage from the practice; another proprietor has followed the example with success.

In giving a detail of the different methods of breaking up old grass land, and of returning it to grass with the courses of crops on the several varieties of soils, I have endeavoured to avoid all theory, and abstract reasoning, mentioning only those practices, the success of which I have witnessed, or have been well assured are successfully practiced by others.

It remains to be considered on what principle an increase of rent ought to be calculated, where permission is granted to break up old grass land now under lease.

Wherever lands can be broken up and cultivated with very profitable crops directly, and without any preparatory expence, and this is the case with rich land long under grass, the landlord ought to be an immediate partaker of such profits. The increased rent which the tenant can afford to give, must depend on the course of crops prescribed, and on the duration of the lease, for if the lease be not to expire for some years after the land shall have been laid down to grass, the increased rent for the whole term ought not to be so great, as when the lease having but a very few years to run, those years in which the land is occupied by very profitable

crops will form a much greater proportion of such lease. In case a heavy expence is to be incurred by bringing land into a state of cultivation in the first instance, as in marling warrens or heaths, or in the drainage of mosses or fens, the rent, I think, ought first to be calculated at what such lands will be worth when so improved, and such a deduction to be made as shall, when the lease expires, have amounted to a sum sufficient to repay the tenant the expence of his first improvement, with good interest for the money so expended.

Where a tenant is to occupy the land after it shall have been returned to grass, the expence of the grass-seeds to be sown, ought, I think, to be charged to his account; but as the landlord is interested in the quantity and quality of such seeds, it may be necessary, in some cases, that he should procure them, to be paid for, by the tenant, not exceeding a certain sum per acre.

When a tenant quits the land which he has sown to grass the preceding year, and has not turned any kind of stock upon the young grass, it is reasonable, I think, that he should be repaid the expence of the grass-seeds; this may be paid by the landlord or by the in-coming tenant, as may be agreed upon by the parties.

On the converting of Grass Land into Tillage and returning it to Grass, after a certain Rotation of Crops. By Mr. William Piu, of Pendeford, Staffordshire.

THE converting of grass land into tillage may be advisable or expedient when grain at any time becomes scarcer than animal food, or when a sufficient quantity of grain cannot otherwise be procured at a reasonable price; for in the present system of living in England, corn or grain for bread is an indispensable article, of the most urgent and pressing necessity, in comparison of which animal food may be considered rather as a luxury. As more human food can in general be produced, and a much greater population be supported from any given quantity of land by tillage for grain, than by pasturage with animals, it will follow, that in all populous countries the bulk of the inhabitants must be supported principally by tillage, and the produce of corn and grain, which furnishes both food and employment for the multitude, and in which the quantity of human sustenance may be increased in almost any given proportion by improved system, and increased industry.

The writer of this Essay has now to state his own pretensions, and how far the different subjects contained in this paper may be considered as experimental. He has been in possession of an inclosed farm of from two hundred to three hundred acres for twenty-one years, the soil a gravelly loam, in part adapted to turnips, and part too cold and moist: he has cultivated most kind of vegetable productions adapted to farming culture, whether established in practice or only recommended in theory. He has at different times, by surveying engagements, been led through extensive districts of the kingdom, and over every variety of soil, and believes he may venture to say, that both at home and abroad he has not been an inattentive observer.

The course and rotation of crops in breaking up of grass land, and continuing it a given time in tillage, must depend upon, and vary with, the nature and quality of the soil. As upon the present occasion an increased quantity of bread corn is a main object, the production of wheat in any proposed course of tillage must be looked upon as indispensable, and therefore I shall on no occasion omit that grain;

after wheat, beans, barley, and oats are of the most importance: peas are, I think, in general best grown upon land in a regular rotation of grass and tillage.

In every case of breaking up grass land, a short tillage is to be preferred, as having the least tendency to exhaust the soil; I shall therefore in general adhere to that system, although if land were kept longer in tillage, its grazing qualities might be restored by top-dressing, taking care that such land be perfectly clean at the end of the tillage.

The different varieties of soil as specified in the advertisement from the Board are five in number, as follows:

I. Clay in all its Distinctions, and Soils too strong and wet for Turnips.

This kind of soil I shall divide into two classes, first, that whose depth of soil, friability or fertility renders it fit for the growth of beans: secondly, that of inferior staple, unfit for beans.

In the breaking up of the first class of this soil, the great object of attention seems to be the production of beans and wheat, beans being the most valuable production next to wheat of which such soil is capable; the great specific gravity of beans is a proof of their superior staple, their weight, measure for measure, being equal to wheat, and I understand that they are capable of being mixed with wheat for bread, with more advantage, and in a greater proportion of weight than any other grain or pulse, and are consequently the great resource in time of scarcity or unkindliness of wheat; when that grain is plentiful, their value for other purposes is sufficiently known.

Next to beans, oats and barley are the sorts of grain most valuable; oats are adapted for the stronger and moister soils, and are a valuable species of grain even considered as a food for mankind; bread made of oats is in general use in Scotland, part of Yorkshire, the Peak of Derbyshire, and the moorlands of Staffordshire; it is extremely palatable and nutritive, and generally preferred by those who use it, to wheaten bread, and I have often wondered that it is not more generally used in other parts of the kingdom, as a change from wheaten bread; the nutritive and restorative qualities of oatmeal in soups and gruels are universally known, and there is not a more healthy or more nourishing food than the groats of oats in various ways; barley is adapted to turnip soils, and cannot often be grown to advantage on strong land; its general employ is in the brewery and distillery, but it may be used

in times of scarcity in the manufacture of bread; in which it is generally allowed to be inferior to beans and rye, which latter is only adapted to dry, weak, sandy soils.

In every case of breaking up turf land with a view of restoring it to grass without injury, I believe either a well managed turnip crop, or a complete summer fallow, to be absolutely indispensable; and that there is no other means of preserving the land in a sufficient state of cleanness and amelioration to insure success to the finer pasture herbage upon returning it to grass; I have therefore purposely avoided introducing cabbages, vetches, or any other fallow crop except turnips, as believing them better adapted to land intended for alternate grass and tillage.

On breaking up the sort of land now in question, the first and succeeding crops should be governed by the circumstances of quality and condition in the soil; upon a mellow, friable clay loam, wheat may be grown the first crop at one ploughing; this is coming to the point directly, and producing the most valuable grain without loss of time, but whether the land be fit for it or not, must be left to the judgment and discretion of those concerned. In this case the course of crops to be,

1. Wheat,
2. Fallow,
3. Barley.

In a fallow for barley the land may be so ameliorated as to be almost certain of a crop, even upon strong soils; of the better kind, grass-seeds to be sown with the barley.

Or, secondly, If the turf be judged fitter for beans than wheat, then,

1. Beans,
2. Fallow,
3. Wheat,
4. Oats or barley, with grass-seeds.

Or, thirdly, If the turf be judged unfit for either wheat or beans, then,

1. Oats,
2. Fallow,
3. Wheat,
4. Barley, with grass-seeds.

Or beans may be introduced the fourth year, and barley with grass-seeds to follow, thus extending it to a five years tillage.

Manure, Draining, and Tillage.—In the breaking up of rich turf land little manure is necessary in the tillage, a good liming or slight dunging of the fallow

being sufficient; but manure will be necessary on the young turf after laying down to grass, to restore the bulk and nutritive qualities of the pasture: this will be again mentioned hereafter.

If drainage be wanting, it is best done previous to the tillage, but it will answer, if properly done, at any time, and will often pay the expence in one crop. The improvements to be effected by drainage rank with the very first of which our agriculture is capable, and the utility and necessity of it cannot be too much enforced.

The indications of want of drainage upon this and every other kind of land are, first, water stagnating on the surface; if this be only rain water, it may be let off by furrows or small surface gutters of a proper depth and fall; but if from springs, hollow drains of a sufficient depth are necessary, or tapping the springs upon Mr. Elkington's system. Another indication of the necessity for drainage is the appearance of aquatic plants upon the surface, as different species of rushes (*juncus*), or of sedge-grasses (*carex*); if these appear amongst the grass, draining should precede tillage.

I am of opinion that good strong soils, fit for the growth of beans, ought not to be pared and burnt.

If wheat be sown on the turf, it should be ploughed in October five inches deep, and the seed sown broadcast, twenty gallons per acre, and well harrowed in; every one who has the least knowledge of farming knows the necessity of laying wheat land subject to be affected by wet, round and dry, with proper gutters or drains to discharge stagnant water, otherwise the plant is sure to perish in winter.

If beans be the first crop, the ground should be well ploughed five inches deep soon after Christmas, and the beans sown or set in February or March, four bushels per acre; where the soil is not mellow enough to cover them to a sufficient depth with the harrows, it is necessary that they should be set by hand: if oats begin the tillage, the land should be well ploughed in February five inches deep, and the oats sown in March forty-five gallons per acre, and well harrowed in; if beans be introduced after fallow wheat, I have known them succeed well by sowing them broadcast upon the wheat stubble early in the spring, and immediately ploughing them in; but it is more common to sow them after ploughing, and to work them in with the harrows.

In fallowing for wheat, the land should be ploughed up soon after Christmas, cross ploughed in May, and harrowed down, then the manure to be got on, which

may be ten tons of dung properly reduced per acre, or five or six tons of clod-lime per acre, which will be one-third more weight when slacked or fallen; the land must have a third ploughing before harvest, and the fourth, or seed-ploughing, should be given about Michaelmas, then sow wheat about twenty gallons per acre; more ploughings must be given if necessary, but four good ploughings well timed, with proper harrowings between, will generally be sufficient for a complete summer fallow.

If this kind of land be summer fallowed for barley, the process will be the same as a summer fallow for wheat, with the precaution of leaving the land at the last ploughing in autumn unharrowed, as it will derive more benefit from the winter frosts by having an uneven surface; it should also be left in such a form as that a single ploughing in spring may lay it in proper form for receiving barley and grass-seeds, and in such manner as it is wished to remain for future pastures.

Some persons advise the introduction of cabbages or vetches in the fallow year; the former might be introduced in a fallow for barley, but not for wheat; and if vetches are sown instead of wheat fallow, they interfere with the proper clearing of the land, and are therefore omitted in a system where breaking up for the most useful grain, and laying down in the best possible order, are the leading objects.

In laying down land for permanent pasture, the best seeds yet in general use are, red and white clover, trefoils, rib-grass, and ray-grass, sown in different proportions, perhaps 6 lbs. of red clover, 6 lbs. of white, 4 lbs. of trefoil, 2 lbs. of rib-grass, and two gallons and a half of fine ray-grass is a good proportion, but some sow much more, especially of the white clover, and some omit the ray-grass.

In some of the best pasture land of Leicestershire I have observed the dogs-tail-grass (*cynosurus cristatus*,) very predominant, the *poas* also abound; I think the production of the seeds of these and some other grasses should be encouraged by premiums.

I know no instance of grass-seeds provided by the landlord; in my neighbourhood they are always found by the tenant; if he is leaving the farm he still finds them, but is generally repaid the expence by his successor. As in the breaking up of turf on any farm, some of the best and most perfect ought to be spared; perhaps it might be a good system when grass-seeds are wanting for laying down to permanent pasture, to save a spot of prime turf for hay; to suffer such hay to grow till the bulk of the seeds are ripe, keeping the ground free from seedling weeds, to lay

such hay by itself till spring, and then thresh out, or well shake out the seeds, which after winnowing may be mixed, instead of ray-grass, with red and white clover and the other seeds. This is worthy of attention, till the best grass-seeds can be found at market.

I shall now proceed to the inferior moist or strong loams, unfit for either beans or turnips.

This kind of land, if tolerable turf, is best continued so, unless it be of sufficient staple and fertility to promise good crops of oats and wheat, in which case the breaking of it up may be equally advisable with any other turf land.

The most proper course for this kind of land is,

1. Drainage and oats,
2. Fallow,
3. Wheat,
4. Oats or barley, with grass-seeds.

Oats seem the grain most generally adapted for the first crop on old turf land when ploughed up, and the ploughing should be given five inches deep, and some length of time before sowing the oats, that the heating and fermentation of the turf may be in part over before the vegetation of the seed takes place, which might otherwise scorch or burn up, and injure the crop. Turf land must be well harrowed, so as effectually to cover the seed. On all good turf soil the large white Poland oat is to be preferred, as being the heaviest grain, and consequently containing the most flour; on inferior soils, the small white Dutch oat, the red oat; and on very poor land even the black oat, or the Tartarian oat may be preferred.

As the tillage and manure on this kind of land is the same for each crop respectively, and for the fallow, as that on the better kind of strong soils, it need not be here repeated; but I shall observe, that in default of other manure, a top dressing of soot laid on wheat in the spring, has been found to have a good effect in forcing a crop. I have the following information on this subject from a friend who has used it largely, and on whose judgment and correctness I can depend: He fetches the soot at any time it can be procured, and lays it down in the wheat field in tight round heaps, a waggon load of about one hundred bushels in each heap; if laid on the wheat it is no object, not damaging more than a square yard of wheat each load; here it may lie through the winter, the rain having little or no effect upon it: the proper time of sowing it is just at the commencement of a vigorous spring vegetation,

generally the beginning of April, it has then a very visible good effect, the quantity about thirty-five bushels per acre, or a waggon-load to about three acres; laid on much earlier, it is believed to do little or no good. It is necessary that the land be free from weeds, and particularly from couch-grasses, for it encourages their growth, and particularly that of the latter, as much or more than that of the wheat.

The laying down of this kind of land to grass will be the same respecting seed, both in sort and quantity, as before; but good hay-seeds will be preferable to ray-grass; and to restore the land to the quality of old turf, top-dressings will be necessary upon the young seeds the first or second year, to invigorate the young herbage, and promote the matting of the turf; such top-dressing may be of dung, or compost of dung and soil, shovellings, town manure, lime and ditch soil, or any other fertilizing substance that can be procured. It is the opinion of many of the best practical farmers, that all manure is best laid as a top-dressing on land at grass, and that it will make greater improvement, and pay better so applied, than in any other way whatever.

Of paring and burning, the writer of this has no great experience; it is seldom practiced in his neighbourhood, where the pulverization of the soil is generally effected by tillage and lime, though the burning of root weeds and rubbish is sometimes practised on tillage lands by the best farmers. Paring and burning is probably most admissible on the soils now in question, (*viz.*) the inferior kinds of moist thin soils, abounding with sedgy grass-wots and other rubbish, not easily pulverized by tillage. It seems still more proper on sedgy waste lands at first bringing them to cultivation, where the proper time to introduce it is in the summer fallow, or in the preparation for turnips. The next variety of soil proposed by the Board is,

II. Loam in all Distinctions fit for Turnips.

On this kind of soil it may frequently happen where the turf is clean, and the soil mellow, that wheat may be grown with advantage upon the first ploughing, in which case the principal grain is produced without loss of time, and I should propose only a three years tillage,

1. Wheat.
2. Turnips,
3. Barley, with grass-seeds, the manure being laid on for the turnips.

But if the turf be judged unfit for wheat, then I propose a four year's tillage,

1. Oats,
2. Wheat,*
3. Turnips,
4. Barley and seeds.

Or, if the oat stubble be unfit for wheat, then,

1. Oats,
2. Turnips, to be eaten of in autumn,
3. Wheat,
4. Barley with seeds.*

Tillage, Manure, &c.—If oats be the first crop, plough five inches deep soon after Christmas, and sow Poland oats in March forty-five gallons per acre, harrowing them well in; these oats will be harvested in August; if the harvest be early, time may admit to give two or three ploughings for wheat, otherwise wheat may be sown at one ploughing of the oat stubble at Michaelmas, eighteen or twenty gallons per acre; between the wheat harvest and Christmas give the wheat stubble a first ploughing for turnips, cross plough and harrow down the following March; give a third ploughing and harrow well in May, then get on the manure, which where procurable may be lime, four to six tons per acre in the live clod, which will be six to nine tons per acre when fallen or slacked. This should be spread in a quick state, and afterwards harrowed till the land is fine: where lime cannot be had, ten tons per acre of well reduced rotten dung may be substituted, and both lime and dung may be used where the state of the land requires it; this manuring should be laid on the end of May or beginning of June; in particular situations other manures may be used, as horn-shavings, old rags, and other town manures. A fourth and sometimes a fifth ploughing will be necessary. The turnips should be sown between the middle of June and the middle of July, and well hoed in August, with a second hoeing afterwards, and hand weeding if necessary, till all the weeds are extirpated. With respect to the best mode of consuming turnips, upon all dry, deep, sandy loams, they are best fed on the land hurdled out in parcels, with sheep and cattle, as tending to improve the staple and fertility of such land, both by their pressure and the manure which they afford; but on moist loams, subject to poach by treading in wet weather, they should be eaten on the ground by sheep only, and those intended for cattle should be carted off in dry weather: as fast as the turnips are cleared off,

* Two successive white-corn crops are bad. *Note added to the MS.*

the land should be broken up with the plough, to ameliorate and lighten it, and if intended to be laid to grass with the ensuing crop, the turnips should be finished before Lady-day, the whole ploughed up and harrowed fine, and the clods, if any there be, broken, and then all ploughed again and sown with barley and grass-seeds before the middle of April; the barley at the rate of from twenty-seven to thirty gallons per acre. The seeds now in established use for laying land to grass are, as before named, 1. red clover, (*trifolium pratense*) a biennial plant; all the attempts to procure the seed of the perennial red clover that have come under my observation have failed; the produce has always been a biennial plant, though sometimes a different variety; 2. white clover (*trifolium repens*) a perennial; 3. trefoil, (*medicago lupulina*,) an annual; 4. hop trefoil, (*trifolium agrarium*,) also an annual; 5. rib-grass, (*plantago lanceolata*,) a perennial; 6. ray-grass, (*lolium perenne*,) a perennial; these are the only seeds at present common at market, and they will generally, upon well cleaned land, form a good turf, if not smothered by a too weighty crop of barley. This accident is likely to happen upon rich old turf land brought into tillage, in which case no alternative remains but to winter fallow the barley stubble, and repeat the sowing of barley and grass-seeds, which in this second case will generally succeed.

If the system of three years tillage be approved, which is worthy of recommendation on proper land, then the turf should be well ploughed in October five inches deep, and sown with wheat, twenty gallons per acre, and well harrowed; the wheat stubble must be turnip fallowed as before, and the turnips succeeded by barley and grass-seeds.

In the third proposed system,

1. Oats,
2. Turnips,
3. Wheat,
4. Barley, with grass-seeds;

the turnips must be eaten in autumn, in due time for sowing the wheat, for which one ploughing only is necessary. This I know from my own experience, as well as from that of others, to be an excellent system, especially upon light loams; the treading of the soil by stock giving it a tenacity and staple peculiarly adapted to the produce of wheat, and if the turnips be consumed so as to finish sowing the wheat at any time before the setting in of hard frost, it will succeed equally well with

the earlier sown. I have known excellent wheat in this way sown as late as Christmas, and even later, and only finished myself this season on the 20th of December: the only objection is the premature eating off the turnips, which objection falls, if sufficient turnips are reserved elsewhere to succeed those first eaten off.

The quantity of grass-seed sown upon an acre, depends much upon the judgment of the cultivator: I have before named under clay soils what I deem a fair allowance. The use of the annual trefoil is to fill up vacancies, which it will do for some years by shedding its own seed; but to strengthen and complete the turf, top-dressing will be necessary, as stated before.

I consider the application of lime as a manure to broken up old turf land, to be of singular utility. Lime is a corrector of acidity in all such soils; it promotes the putrefaction and dissolution of vegetable roots, banishes or destroys worms and insects, assists in the pulverization of the soil, and tends to render the mass of vegetable mould mellow and productive. This superior mellowness of the soil is even visible to the eye, as I have often observed upon breaking up a piece of land with the plough the next season after liming; a friability and amelioration are apparent, and not to be obtained without the application of this substance. The courses of crops I have here proposed for turnip loams are well known, and have been practised by many others as well as myself with propriety and advantage.

With a view of improving the pasture herbage, many people as well as myself have sown on mixed gravelly loams, on laying them down to grass, the upland burnet, (*poterium sanguisorba*) a hardy and strict perennial; but I am now thoroughly convinced from the most satisfactory observation that we have sown it on the wrong soil, and that this plant is only adapted to chalk downs, or other high and dry lands strongly calcareous, where it forms a durable and productive sheep pasture, of which more shall be said under the article chalk land and downs.

III. Sands, including Warrens and Heaths, as well as rich Sands.

The following tillage I have known to succeed pretty well on barren, dry, sandy heath land upon a considerable scale, and it is equally applicable to the cultivation of warren land. First burn or grub off the rubbish, so as to permit the plough to pass; then provide a strong plough and stout team, so as to be able to fetch up a furrow of at least double the usual depth, viz. a furrow of ten or twelve inches deep; then rough harrow and work the land level, and allow it time to ferment and rot;

afterwards work it with a common plough, and harrow till it be fit to receive the seed of buck-wheat; this may be done in one season, by giving a winter and spring fallow. Where the buck-wheat by its luxuriance shows superior fertility in the soil, it may be reserved for a crop, and the inferior parts ploughed in green, for manure; this will bring the field to a more equal state of fertility; the whole to be sown with rye in autumn; and after the rye is harvested, ploughed up and well worked for turnips, the turnips eaten off with sheep, and the land sown with barley and the grass-seeds before mentioned, and particularly ray-grass and rib-grass, the whole then to lay two or three years for a sheep pasture, and to be afterwards broken up for turnips, and brought into the turnip and barley cultivation, upon the Norfolk system.

Manure, &c.—The manuring of such land must depend wholly upon local circumstances; where lime is procurable, it should be applied as soon as the land is sufficiently levelled and pulverized to receive it. Paring and burning in this case, where there is any thing for the fire to act upon, seems not improper, and sheep folding should be used if a flock can be supported, or as soon as turnips can be raised. Marling on the turf, if marling can be had after the first laying to grass, must be of singular advantage in the future tillage of poor, weak, sandy land; and short tillages, with alternate laying to grass for sheep pasture, may, by degrees, enable such land to produce turnips and useful grain.

The cultivation to which I refer in this paper, was in actual use; I was acquainted with it some years back, when it was in a course over some hundred acres of poor, sandy, common land, and had then been carried on some years, and in different lots of the land were in various stages of improvement, a considerable tract had been planted: some lots were under fallow for buck-wheat, others in a course of turnips, barley, &c. The system had been well planned, and ably executed, and seems applicable to poor, sandy heath, and warren land. I was personally acquainted with these premises a few years ago during the greater part of one summer, but owing to considerable distance, and some other circumstances, I am since unacquainted with the further progress. I am to add that no lime was procurable, nor chalk but at a considerable distance, nor had marle or any calcareous substance been applied.

The tillage and course from a state of nature would be nearly as follows:

1. Deep ploughing and harrowing, winter and spring fallowing, burning of turf and rubbish for buck-wheat,

2. Rye at one or more ploughings, to succeed the buck-wheat,
3. Turnips with the usual culture, and lime if procurable, to be eaten on the ground by sheep,
4. Barley and seeds,
- 5, 6. Sheep pasture, with chalk or marle on the turf, if procurable, to be followed by the Norfolk system of culture.

Rich sands are adapted to the Norfolk culture, and to the growth of carrots. Upon the breaking up of a good deep sandy loam or rich sand, there can be no doubt of wheat succeeding upon one ploughing; the production of the most valuable and necessary grain in the first instance, and with the least delay, must of course be a desirable circumstance. The turf in a light soil possesses tenacity favourable to the growth of wheat, which is lost upon pulverization; upon the breaking up of good sandy loam I would therefore propose the course of

1. Wheat,
2. Turnips or carrots,
3. Barley and grass-seeds.

The tillage will be, by ploughing up the turf in October, five or six inches deep; then sow wheat, after well harrowing the land. I think October, or even November, early enough for sowing wheat upon dry sound lands; the tillage for turnips and barley will be the same as stated before for loamy soils: if any manure is applied in the tillage, it may be for the turnips; lime, if procurable, otherwise dung as before, under the article loam. Top dressings of soot laid upon the wheat in the spring answer extremely well upon all sound lands, both for the wheat crop and the future amelioration of the soil. On laying rich light lands to grass, white clover should be sown abundantly, eight, ten, or twelve pounds per acre, which with a top dressing of dung upon the seeds, will soon restore the turf, in all probability to a more luxuriant and productive state than before.

Respecting the question, whether it be most proper to mow or feed young grasses the first year after laying down; I believe a good turf may succeed in either case, observing the following cautions: first, the land must not be grazed by any stock, or in any weather liable to occasion treading, poaching, or breaking up of the soil; consequently sheep are the most proper stock, and dry weather the most proper season for grazing young seeds; but, secondly, no sheep, or other stock must be suffered to pasture, or even tread young seeds in frosty weather the first winter; they will eat

out the heart of the plant, particularly the red clover, after which the wet will penetrate into, and rot and destroy the plant; and even treading in frost will cause the plant to wither and perish. Young seeds should therefore be sparingly grazed the first autumn, just to level and lop off the shoots, which might otherwise wither in winter; and upon the first symptoms of frost, all stock should be taken away and kept out till the seeds have acquired a good state of growth in the spring, and become a good pasture, when it may be grazed or further saved for mowing at pleasure. I have known good turf succeed in either way, and believe it difficult to say whether the one practice be superior or preferable to the other.

The most general crop with which land is laid down to grass, is barley; but I have known instances of equal success both with oats and wheat. If land be laid to grass with oats, it should have the same ploughing, harrowing, and pulverization, as if barley were sown, and the seeds will then succeed equally well: I have also had excellent and bulky clover crops by sowing clover-seed upon fallow wheat in the spring, harrowing it in with light harrows, and afterwards rolling the land; and this practice is applicable to light land under the course. Turnips eaten off early, and the land sown with wheat; grass-seeds sown upon the wheat in the spring with a top dressing of soot, and there is little doubt of excellent turf being soon restored by top dressing with dung or compost on the young seeds. In this case the whole course of crops would be,

1. Break up the turf, and sow the grain or pulse most suitable to the land, wheat, oats, pease, or barley,
2. Turnips with the usual cultivation, manured with lime or dung, and eaten off in autumn,
3. Wheat with grass-seed, and a top dressing in spring.

In this course, well managed, valuable products are quickly raised, and the land soon restored to its pristine state, but with renewed vigour.

It has been recommended by theoretical writers to sow grass-seeds alone, without any other crop, either in spring or autumn; but this is mere theory, and will not stand the test of experience: an increase of labour, and decrease of produce, would generally be the consequence. Grass-seeds sown alone in autumn would require a ploughing on purpose, and would be washed to perishing by the snows and rains of winter. Some years back I sowed a single acre in the midst of a ten acre piece of barley and seeds, with seeds alone; the produce of the seeds were the worst in the field, the

most smothered with weeds, and the least productive. The weak and tender vegetation of young clover and grass plants are sheltered, covered, and protected by the crop under which they grow; and by the time such crop is cut away, the plants have acquired sufficient strength to bear exposure to the atmosphere.

The principle upon which an increase of rent ought to be estimated upon permission to break up old pasture land under lease, is difficult to be ascertained. I know of no precedent to refer to; but if the public and the tenant be benefited by such permission, the landlord will doubtless have a right to claim a share of such benefit. The tenant, however, may conceive, that though some present advantage may arise from the produce of grain, a future injury or loss may be sustained during the time necessary for the restoration of the turf: for want of *data* from which to deduce any better conclusion, I would propose a double rent to be paid by the tenant for such land in each year, when it should produce grain, pulse, or potatoes, but nothing additional for the fallow or turnip years; a proper system of tillage and manure should also be fixed upon, which system must be governed by local circumstances.

IV. Chalk Land and Downs.

Of the cultivation, manuring, and tillage of chalk and down land, the writer of this has had no experience, and therefore confines himself to a circumstance which respects laying down such land to pasture; which is, that all such lands (and he believes such lands alone) are adapted to the growth of the upland burnet (*poterium sanguisorba*): this plant is a native of high dry lands strongly calcareous, where it retains perpetual verdure, neither scorching, withering, or burning up in the hottest or driest seasons, nor fading in winter, and where it is an excellent sheep plant. The writer of this has observed it indigenous on the moorland hills of Staffordshire, and the Peak hills of Derbyshire, the staple of both which, is lime-stone; but more particularly on the chalk downs of Wiltshire. A few years ago riding over Salisbury Plain, between Salisbury and Everley, he observed here and there a tallish, but small flowering stem of some plant, which on alighting to examine, he found to be the plant here recommended, and that the staple of the herbage consisted of it, but closely shorn down by the large flocks of sheep that daily pass over it; the flocks there are of several hundred each, and the land ranks with the best store sheep land of England. This plant is peculiarly adapted to close and hard biting; I should therefore strongly recommend that, upon the laying of such land to grass, there be sown upon

each acre half a bushel of burnet-seed; the seed is procurable in London, and may be easily raised in any quantity; and the reason it is in no higher repute as a pasture plant, is owing to its having been sown upon improper land; the plant has a long taproot, drawing its nourishment deep out of the earth, and therefore not interfering with the growth of surface plants. To the half bushel of burnet may be added 6 lbs. of white clover, 4 lbs. of trefoil, and a peck of ray-grass, which I recommend as an excellent mixture for sowing upon each acre of chalk and down land on laying it down to grass.

V. Peat, including moory, sedgy, rough Bottoms, and Fens.

Before peaty lands are brought into cultivation, an effectual drainage is in the first place necessary. A method of effectually draining peat land has been accidentally taught in my neighbourhood several years since by the cutting of canal navigations. The peat being generally from four to six feet thick, upon an under stratum of loose sandy gravel, drains cut in the peat had but little effect, and soon grew up; but upon cutting a canal to a depth of sixteen or eighteen feet, which is ten or twelve feet into the sandy gravel, a whole morass was immediately and effectually drained; the same effect has been frequently, though partially, observed elsewhere from a similar cause. The general method therefore of effectually draining peat land is to carry a deep and roomy open drain quite through it, and from one to two feet into the loose understratum, and to gain sufficient fall to clear and discharge the whole: such a drain becomes a perennial stream; the surface of the land to a considerable distance will settle, and has been known to sink by its own pressure, from one to two feet perpendicular.

Peat, called by Lord Dundonald, "inert vegetable matter," upon effectual drainage, consolidation of parts, and succeeding pulverization, recovers its active vegetable powers, and becomes of considerable fertility, and will, in some cases, produce large crops of potatoes and hemp. I understand that in Nottinghamshire hops are successfully cultivated upon peat; but it is generally unkindly for grain, running too much to straw, and seldom filling the ears well, so as to form a plump and heavy grain. I have had this sort of land under cultivation for grain; the straw generally run long and flimsy, incapable of supporting itself, the ears long set, but the grain thin and light, and it takes some length of time to restore a turf. The varieties of grain best adapted for it are the cone, or bearded wheat, the battledore,

or sprat barley (*bordeum zeocritlon*), and I believe the Poland oat, from its strength of straw.

As peat land is adapted to the production of large crops of potatoes, I think, after effectual drainage, they should be the first crop; the next crop may be cone wheat immediately after cleaning off the potatoes, and the third, barley or oats, with grass-seeds.

But the management and course of crops upon peat land must depend much on local circumstances; for some such land, even after drainage, will not very soon bear a team to plough or harrow, in which case the spade or fork can alone be used; if a team can be employed, a clean summer fallow for wheat, or turnips, or barley, according to circumstances, will much improve the neatness of appearance and cleanness of the land at laying to grass, and will be a means of destroying sedgy roots and coarse herbage.

Upon all lands of this class that are sufficiently dry, I propose potatoes as the first crop, and in many cases potatoes may be repeated, then wheat, or spring corn, or fallow, or turnips, according to circumstances, more particularly as follows.

Courses of crops and tillage proposed for the fifth class of land, viz. peat, including moory, sedgy, rough bottoms, and fens:

1. Potatoes planted upon one ploughing, or after digging with the spade,
2. Bearded or cone wheat,
3. Fallow or turnips,
4. Spratt barley with seeds.

If the seeds should be smothered by an over weighty crop, no alternative remains but to winter fallow the land, and repeat a spring crop of oats or barley, with grass-seeds.

If the soil be rich and well pulverized, the tillage for

- 1, 2, 3. Years may be as before,
4. Hemp,
5. Barley, and grass-seeds.

In this case, the hemp preceding the barley may present a superabundant produce of straw in the latter crop, and so preserve the seeds.

On moory and sedgy, rough bottoms,

1. Potatoes, which such lands, with tolerable management, will generally produce,

2. Summer fallow, burning or clearing off all rubbish that will not decay or rot of itself,
3. Wheat,
4. Barley or oats with grass-seeds.

On deep peat I think no manure should be laid during tillage, as it will be liable to sink or be trodden down too low beneath the surface.

If a peaty soil after draining be too tender to support or bear a team (which may often be the case until a considerable length of time has been given for consolidation) the following course may be easily practised :

1. Potatoes by hand-work,
2. At getting them up fork the land into a proper form to receive wheat, which may be raked in,
3. Dig and lay the land in a proper form for future meadow or pasture, and sow oats or barley with grass-seeds, which may also be raked in.

Or, if the turf be not sufficiently rotted with the first potatoe crop it may be repeated,

1. Potatoes,
2. Potatoes,
3. Wheat,
4. Barley or oats with grass-seeds.*

With the last sown crop a top dressing of lime would be highly advisable: I believe the extra expence of laying down a meadow with the spade would be in a great degree compensated by the superior form and neatness of surface which might that way be obtained, more particularly if it be in a situation for future improvement by irrigation or watering.

The proper grass-seeds are those before recommended for loamy soils, but good hay-seeds are to be preferred to ray-grass; and as peaty soils are apt to exhibit vacant spaces amidst the young grasses, they should be looked over the first spring after laying down, and such vacancies strewed over with ray-grass or hay-seeds, hoeing or raking in such seeds, after which top dressings of dung or compost will restore the turf, so as to be equal or superior to its pristine state, after having given a plentiful supply of human food.

* A dreadfully scourging course.—*Note added by a Member of the Board.*

I shall now mention some objections which I have heard, or which have occurred to me, against breaking up old turf land, together with such obvious reasons as may counteract those objections which will conclude what I have to say upon the subjects contained in the advertisement from the Board.

At a meeting of the Leicester Agricultural Society, at which I was present, a question was put and discussed, whether in any case the breaking up of good old grass land was advisable or admissible, and was almost unanimously carried in the negative, and a vote passed, that the nutritive qualities of rich old turf, broken up for tillage, could not be restored in forty years; this, however, I do not consider as decisive of the question, for the company present were almost entirely breeders or graziers, and consequently partial to grass land and live stock. Secondly, a pressing scarcity of grain may render that proper and expedient, which might not be so, under contrary circumstances; and further, there can hardly be a doubt but that large tracts of slovenly, uneven, and uncouth old pasture lands, now producing much unsightly and useless herbage, may be sooner and more effectually cleaned, and its herbage improved in a judicious course of tillage, than at grass: in the mean time large crops of grain may be produced, and ample amends are thus made both in a public and pecuniary view, for any small falling off in the quality of the pasture, which may afterward be restored with increased vigour.

Yet a too general breaking up of meadow and pasture land, or upon too large a scale, would be reverting towards a state of unimproved nature; for in many cases the forming of such to their present state has been a work of ages, and I look upon a highly improved meadow or pasture, to be land brought to the highest possible state of perfection, as producing annually, and almost spontaneously, articles almost equal both in value and nutriment to a cultivated field of equal size with the addition of labour. Thus an acre of rich pasture will produce from a beast, five hundred weight of cheese, or a quantity of butter, or beef, or milk, nearly equal in value and nutriment to an average acre of wheat, and that with much less labour than is required to cultivate an acre of land in tillage, although the latter is not every year productive.

In the breaking up of grass lands, therefore, the best meadows and pastures must be spared, and the system confined to such land as may evidently be restored to grass in an improved state, in which, though the quality of the turf may be temporarily injured, it will be permanently improved. In this country the demand for animal

food, and the produce of grass land, seems nearly to keep pace with that for grain and the produce of tillage; the true and permanent remedy therefore must be in the speedy cultivation of our unproductive wastes, and the general improvement of our whole breadth of land, whether in tillage or at grass, by a combination of which, it is very probable that a double quantity of human food to what is produced at present may be obtained. This may be brought about in a few years by a *general inclosure*, and a generally improved cultivation, which would be the means of making a vast addition to the number of hands now in agricultural employments, and tend permanently to advance the riches, the strength, and the security of the empire.

A D D E N D A.

Upon re-perusing these papers, the most material omission that occurs to me, is the not having laid sufficient stress upon the production of potatoes, having mentioned them only on treating upon peat or low soils; but they are equally well adapted to loams of every description, which will produce them of superior quality: they also succeed peculiarly well upon turf or grass land at first breaking up, where large crops may be expected; their cultivation is well understood by every attentive labourer, and they may be planted in various ways; but upon turf land I am inclined to prefer hand work, to every other method. The dung may be better applied, and the work neater and better done than by the plough, and the superior produce will very probably much more than pay the extra expence. To insure large crops of potatoes, a portion of manure will generally be necessary, and the best manure is the littersy dung of a farm-yard: about twenty cart loads per acre, fifteen hundred weight per load, will generally be sufficient on turf land, and three hundred or four hundred bushels per acre of potatoes, eighty pounds to the bushel may, with good management, be expected.

The course of tillage upon a turnip loam should be,

1. Potatoes,
2. Wheat,
3. Turnips,
4. Barley, with grass-seeds.

If the land be improper for turnips, then,

1. Potatoes,
2. Wheat,
3. Fallow,
4. Barley ; or,

1. Potatoes,
2. Wheat,
3. Fallow,
4. Wheat,
5. Barley or oats, with grass-seeds.

The tillage &c. as follows: First cart on the manure, laying it in regular heaps; eight heaps from a cart load, and twenty loads per acre, gives a heap in every square perch. The improved mode of digging for potatoes is here called double digging, to effect which, a trench of about two feet wide must be kept open between the turf and the finished land; into this trench is first thrown a thin spit of the turf, chopped small, spreading it all over the trench, then with a fork or prong, shake the dung equally over the trench upon the chopped turf, and cover it with the under soil; a fresh trench is thus formed, which must be filled up as before; the land is commonly laid in beds of about four yards wide each. This operation costs 8d. per rod of sixty-four square, or 50s. per acre, nearly; the setting is 1d. for every such rod, or 6s. 3d. per acre, and a horse with small barrows may go over the ground, to cover in the sets; or the same thing may be done by going over the land with a hoe. The process and manure for the succeeding crops will be the same as mentioned before in treating on loamy soils.

But if the cultivator prefers it, the plough may be used; in which case, first cart on and spread the dung; then a furrow, being first ploughed: hands should be employed to sweep in the dung with a fork, by which means it may be equally distributed, and evenly buried, and the potatoes may be set by hand as before: twenty bushels of potatoes are the allowance to plant an acre.

After the potatoe crop is cleared off, wheat may be sown upon one ploughing, and harrowed in ; and if the business be neatly done in due season, and the land free from couch grass, a bulky crop will generally be produced ; but before returning the land to grass, a well managed turnip crop, or a complete summer fallow, will in general be necessary, with due attention to which, the land may be restored to grass, as little injured, as though grain alone were cultivated, and after having, in the same length of time, produced a much larger supply of human food.









